THE TRAVIS PEAK FORMATION OF CENTRAL TEXAS

Approved:

[redacted]

THIS IS AN ORIGINAL MANUSCRIPT
IT MAY NOT BE COPIED WITHOUT
THE AUTHOR'S PERMISSION

Approved:

[redacted]

Dean of the Graduate School.

April 29, 1931.

THE TRAVIS PEAK FORMATION OF CENTRAL TEXAS

THESIS

Presented to the Faculty of the Graduate School of
The University of Texas in Partial Fulfill-
ment of the Requirements

For the Degree

of

DOCTOR OF PHILOSOPHY

By

Robert Hamilton Cuyler, B. A., M. A.
Austin, Texas
June, 1931

PREFACE

The purpose of this paper is to increase the available information regarding the Travis Peak formation of Central Texas by presenting the new material pertaining to its general character, variations in thickness, detailed sections, and, insofar as possible, accurate descriptions of its fossils.

ACKNOWLEDGMENTS

The writer is indebted to Dr. F. L. Whitney under whose supervision this work was done, for his constant encouragement, suggestions, helpful advice, interest, generosity in contributing his collections of fossils, his company in the field, for his help in photographing the fossils, and for his valuable criticisms of the manuscript.

To Dr. F. W. Simonds, the writer wishes to express his sincere appreciation and gratitude for constant encouragement and helpful suggestions during the preparation of this paper.

To Dr. F. M. Bullard, the writer is especially grateful for valuable criticisms, for his help in making the photographs other than fossils, and for reading the manuscript.

To Dr. F. McAllister and Dr. B. C. Tharp, the writer wishes to extend his sincere thanks for their trouble in reading the manuscript and for the personal interest shown by them.

To Mr. V. A. Brill, the writer is grateful for the use of information taken from his thesis,

which is in manuscript form and for the use of the collections of Travis Peak fossils which he left with the Department of Geology.

Use has been made of the published material concerning this subject and credit is acknowledged in each case.

TABLE OF CONTENTS

Page

Page

LIST OF ILLUSTRATIONS

Page

LIST OF TABLES

THE TRAVIS PEAK FORMATION OF CENTRAL TEXAS

INTRODUCTION

The Travis Peak formation is a term applied to that portion of the Basement sands existing in and south of Burnet County, Texas. It was so named by Robert T. Hill[1] in 1889 because of its excellent exposures in the vicinity of the Travis Peak post-office, Travis County, Texas. At the type locality, its thickness is about 263 feet, but it increases to the southeast, south, and southwest.

Since the formation was originally described, many references have been made to it in literature. Hill contributed the majority of these; but Taff, Cragin, Burckhardt, and others have also made their contributions to our knowledge of the formation. Mr. V. A. Brill studied this formation and wrote a thesis, "The Travis Peak Formation", which he pre-

---

[1]Hill, R. T., Cretaceous Rocks of Texas and Their Economic Uses: Geological Survey of Texas, First Annual Report, p. 118, 1889.

---

sented to the University of Texas in partial fulfillment of the requirements for a Master of Arts degree.

A reconnaissance was made of the outcrops of the formation in Burnet, Williamson, Travis, Blanco, Hays, and Comal counties. In order that those not acquainted with the outcrops of the Travis Peak formation may find them without difficulty, a list of localities where good exposures can be observed is given below:

1. Along the Colorado River between the valleys of Sycamore and Cypress creeks, in Burnet, Blanco, and Travis counties.

2. Below the Travis Peak post-office on Cow Creek, Travis County.

3. From the top of the divide between Hickory and Cow creeks and continuing to the Colorado River level at the mouth of Hickory Creek, Burnet County.

4. Near the house of Mr. Hensell at the Travis Peak post-office, Travis County, where the Hensell sands are exposed at their type locality.

5. On Cow Creek, above the entrance of Postoak Creek, Travis County, where the Cow Creek beds are well exposed at their type locality.

6. Along the slopes of the Colorado Valley from the river level at the crossing of the Burnet-Travis county line to a point a mile or two back of Sycamore Creek where the Sycamore sands outcrop at their type locality.

7. In Comb's Hollow below the junction of the main Austin-Smithwick highway and the Liberty Hill road, Travis County.

8. In Turnback Creek between Cow Creek and Comb's Hollow where the Cow Creek beds and Hensell sands outcrop.

9. Along Spanish Oak Creek, Burnet and Travis counties, where the middle and upper portions of the Travis Peak are exposed.

10. About three miles east of the town of Spicewood, in Travis County, where the basal conglomerate of the Travis Peak outcrops.

11. The bluff on the west side of the Pedernales River, about three-fourths of a mile up the river from Cox's Crossing, Travis County, where there is an exposure of the Cow Creek beds. The basal conglomerate may be observed in the bed of the river at this locality.

12. About five miles west of Cox's Crossing on the south side of the Austin-Marble Falls highway, Burnet County, where there is a good outcrop of the upper sands of the Travis Peak overlain by the Glen Rose-Travis Peak contact.

13. Mr. B. B. Milam's place, on the southeast side of the Pedernales River, about two miles from Cox's Crossing, Travis County, where the middle and upper portions of the Travis Peak outcrop.

14. On the bluffs of the Pedernales River at Hammett's Crossing, Travis County, where the Cow Creek beds are well exposed.

15. On the hills south of the highway on the east side of the Pedernales River, Hammett's Crossing, Travis County, where the Cow Creek beds are exposed.

16. At West Cave, about one-half mile west of the Pedernales River, in the first creek north of Hammett's Crossing, Travis County, where the Cow Creek beds are exposed.

17. Hamilton Pool, about one and one-fourth miles east of the Pedernales River, and about one-fourth mile north of the highway from Hammett's Crossing to Austin, where there is a good exposure of the Cow Creek beds.

18. Dead Man's Hole, Hays County, about two and one-half miles airline in the direction S 40° W from Hamilton Pool where the Cow Creek beds and Hensell sands are beautifully exposed.

19. At the town of Spring Branch, Comal County, where the sands of the upper Travis Peak outcrop.

20. On Rebecca Creek, Comal County, about four and one-half miles in a northeast direction from Spring Branch where the Cow Creek beds are well exposed, forming high bluffs on each side of the creek.

21. Along the north bank of the Guadalupe River, about one mile upstream from Speck's Crossing, Comal County, where the middle and upper portions of the Travis Peak outcrop.

22. On the hills southwest of Speck's Crossing of the Guadalupe River, Comal County, where the upper portion of the Travis Peak outcrops.

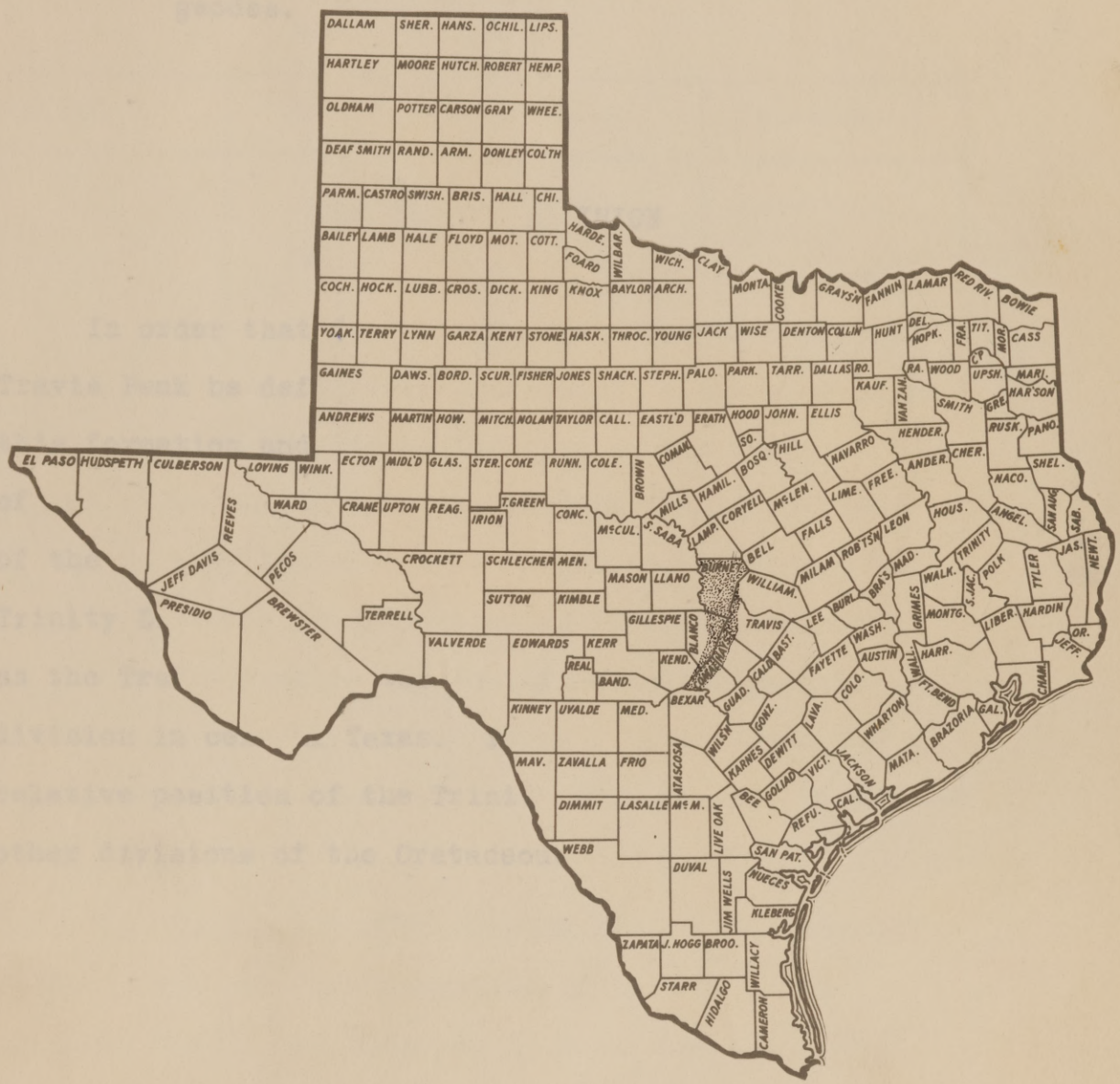


Figure 1. Map of Texas Showing Area Under Consideration

23. Along the New Braunfels-Blanco highway at the junction of the first Spring Branch road west of New Braunfels, where there is a good assortment of geodes.

THE TRINITY DIVISION

In order that the stratigraphic position of the Travis Peak be definitely understood, a correlation of this formation and its equivalents in the other parts of the state, along with the general classification of the Trinity Division will be considered here. The Trinity Division is of particular interest inasmuch as the Travis Peak is the lowest formation in this division in central Texas. Table I illustrates the relative position of the Trinity with respect to the other divisions of the Cretaceous.

TABLE I

GENERALIZED SECTION OF THE CRETACEOUS OF CENTRAL TEXAS

Period	Series	Division	Formation
Cretaceous	Gulf	Montana	Navarro Taylor
		Colorado	Austin Eagle Ford
	Comanche	Washita	Buda Del Rio Georgetown
		Fredericks-burg	Edwards Comanche Peak Walnut
		TRINITY	Glen Rose TRAVIS PEAK

The Trinity Division extends from Mexico through Texas to the Arbuckle Mountains in Oklahoma. In southern Texas, the division is represented by the Basement sands and the Glen Rose formation. There is a gradual change from south to north, the Trinity being represented in the south by sediments of a cal-

careous nature, for the most part, and in the north by sands almost exclusively. In central Texas, the division is represented by the Travis Peak, or Basement sands, Glen Rose, and sometimes the Paluxy formation. To the north, the Paluxy sands assume importance as part of the Trinity Division at the expense of the Glen Rose. The lower portions of the Trinity thin rapidly to the north. A short distance north of Fort Worth, the Glen Rose limestones are entirely lacking, these beds disappearing into the central portion of the Antler sands. Along the Red River, in the extreme northern part of the state, the Trinity division is represented entirely by the Antler sands. Table II illustrates the classification of the Trinity Division in Texas as given by Hill.[2]

---

[2]Hill, R. T., Geography and Geology of the Black and Grand Prairies, Texas: U. S. Geological Survey, Twenty-first Annual Report, Part 7, p. 115, 1901.

TABLE II. do not take

THE SUBDIVISIONS OF THE TRINITY DIVISION IN TEXAS

Division	Major Formations	Denison Section	Fort Worth Section	Waco Section	Austin Section	Uvalde Section
Trinity	Paluxy	Antlers[3]	Paluxy	Paluxy		
	Glen Rose		Glen Rose	Glen Rose	Glen Rose	Glen Rose
	Travis Peak		Basement sands, not named	Basement sands, not named	Travis Peak	Concealed

[3]Now called Trinity.

The term "Basement sands" is used to designate the lowermost formation of the Cretaceous. Inasmuch as these beds are not of synchronous age, the deposits vary according to the locality changes. The Basement sands are present from Burnet County to the northern part of the state. South of Burnet County, the Basement sands are represented by the Travis Peak formation. This formation exists southward, the exact southern limit being indefinite; paleontological equivalents for the formation, however, are present in Mexico. Well records indicate that the formation is best developed southward and southeastward from Burnet County. This condition would be expected inasmuch as the main catchment basin formed by the Travis Peak sea was in that direction.

Due to the overlap caused by the advancement of the Trinity sea, the various formations of the Basement sands are different in age. Local names are given to series of strata in areas where sufficient lithological changes have taken place to show diverse characteristics. The "Travis Peak" is one of these local terms, hence the horizontal

extent of the formation does not include a large area. For this reason, the Travis Peak has no equivalents north of Burnet County, the formations of that area being younger stratigraphically. The formation is considered as being equivalent to the Upper Aptian of the European Infracretaceous.[4] Paleontologic criteria for this correlation is included under "Paleontology."

GEOLOGIC HISTORY

A clear knowledge of the geologic history of the entire Trinity Division is essential to the understanding of conditions under which the Travis Peak was deposited. These conditions, the position of the land masses which furnished the sediments for the division as a whole, the approximate depth of the sea when the different sediments were being deposited, the direction of encroachment of the old Trinity sea, the rapidity

---

[4] Böse, Emil, and Cavins, O. A., The Cretaceous and Tertiary of Southern Texas and Northern Mexico, University of Texas Bulletin, 2748, p. 13, 1927.

with which it advanced, and the relative ages of the various formations of the division are rather well known.

In general, sediments of the Trinity Division were deposited on a subsiding sea floor, the chief sources of supply being (1) Ouachita Mountains, (2) Arbuckle Mountains, (3) Wichita Mountains, (4) Llano-Burnet region, and (5) other older sedimentary rocks. The nature of the sediments indicate near shore deposits resulting in the deposition of conglomerates, sands, sandstones, sandy clays, and arenaceous limestones in abundance.

The present distribution of the formations in the Trinity Division does not represent the western boundaries of the old Trinity sea, for it is only the erosional remnant of deposits which extended farther to the west and northwest. The eastward continuations of these beds are overlain by hundreds of feet of sediments deposited by subsequent Cretaceous seas. The first encroachment of the Cretaceous sea on the area of Central Texas came from Mexico and the southeast. This incursion was made by a shallow epicontinental sea of Trinity age which advanced very rapidly upon the older

rocks. The nature of the sediments indicate shallow, near shore conditions, and the rapid advancement of this early sea. The Paleozoic land mass upon which the sea advanced rose gradually to the north and west. Because of this encroachment of the sea from the south, the Basement sands, or basal Cretaceous sediments differ in age in various localities, becoming younger as they extend northward from southern Texas, until in southern Kansas, they are of Washita age, although they represent the initial deposits of the Cretaceous sea in that area.

Inasmuch as the Travis Peak formation is a part of the Basement sands, the conditions under which it was deposited would be the same as heretofore presented. The chief source of sediments comprising the formation was the land mass constituting the old Llano-Burnet uplift. The nature of the sediments of the Travis Peak indicate that this region was doubtless very high topographically. The edge of the mass must have sloped very rapidly toward the sea and the gradients of the streams must have been steep, in order to produce a con-

glomerate with such large boulders as those found in the basal Travis Peak. These boulders, which are large and well-rounded, indicate that they must have been transported some distance from their origin and carried in a stream with a relatively swift current. They are frequently fragments of Ellenberger and Marble Falls limestones, granites, schists, and quartz derived from the adjacent Pre-Cambrian, Paleozoic, and Igneous rocks. The region must have been much higher in the early Travis Peak times than later because the sediments grade from very coarse conglomerates to fine-grained materials. The lowering of the land mass during Trinity times might have been caused by erosion or by structural conditions. As the old land mass was eroded, the sea advanced on the land and the materials deposited away from shore were fine and calcareous, as indicated in the upper portion of the Travis Peak.

Incident to being deposited on an irregular sea floor, the thickness of the Travis Peak formation in different localities varies. Minor irregularities in thickness of the different members of the formation are frequently encountered, particularly with reference to the sandy phases which show

variations in conditions of deposition. Inasmuch as the invasion of the sea was from the south and east, the formations are thicker in those directions. The differences in thickness and other characteristics of the formation are considered in detail under "Stratigraphy".

TOPOGRAPHY

The Travis Peak formation weathers into two distinct types of topography. Those beds which are consolidated and hard in nature, the Cow Creek beds, form a roughly dissected surface; whereas, those portions of the formation which are characteristically soft, the Sycamore and Hensell sands, form a relatively smooth surface and a gently rolling topography.

Wherever the Cow Creek beds outcrop, the region might be expected to be rough and hilly. If a valley is cut in these beds by stream action, it will be in the form of a canyon with steep walls on each side, forming sheer bluffs. Examples of such topography may be observed on the Pedernales River, at Hammett's Crossing, or anywhere along the

river between these places. The accompanying photographs illustrate the topography characteristic of these localities:

Figure 2. Precipitous walls along the Pedernales River caused by the erosion of the Cow Creek beds at Hammett's Crossing, Travis, County.

Figure 3. Cow Creek beds forming steep canyon walls along the Pedernales River at Cox's Crossing, Travis County.

Other examples of this same type of topography have been observed on Rebecca Creek and Speck's Crossing, Comal County. The limestone phases of the Travis Peak at these localities weather similar to those outcrops along the Pedernales River and at the type locality of the Cow Creek beds in Travis County. Examples of the Cow Creek beds in Comal County are illustrated in the succeeding photographs:

Figure 4. Cow Creek beds forming bluffs at Hamilton Pool, Travis County.

Figure 5. Cow Creek beds along the Guadalupe River at Speck's Crossing, southwest of Spring Branch, Comal County.

The comparatively soft members of the formation, particularly the upper portion, the Hensell sands, form a relatively smooth and gently rolling topography. Examples of such topography are illustrated in the following photographs:

Figure 6. Hensell sands exposed at the type locality near Mr. Hensell's house, the Travis Peak post-office, Travis County.

Figure 7. Soft, sandy material overlying the Cow Creek beds at Hammett's Crossing, Travis County.

Figure 8. Gently rolling topography caused by the erosion of the sands of the upper Travis Peak about two miles east of Spicewood, Burnet County.

Another topographic feature peculiar to the Travis Peak formation is the presence of large crescent shaped holes. These holes vary from about 50 to 200 feet in diameter and occur along the courses of small streams, and are formed because of the difference in the rate of weathering of the Cow Creek beds and the softer strata which lie directly beneath. The more rapid weathering of the Sycamore sands beneath the limestones of the Cow Creek causes the heavier beds to be undermined. The result of such action is the formation of a semicircular hole, often a hundred feet or more in diameter, and frequently forty or fifty feet deep. Generally a waterfall is also present, the fall being developed over the Cow Creek strata. The roofs of these cavern-like holes are usually ornamented by numerous stalactites. Dead Man's Hole, Hamilton Pool, West Cave, and Curiosity Cavern are among the beautiful examples of this type of topography which is commonly a feature of the Travis Peak formation. The following photographs illustrate this phenomenon:

Figure 9. Dead Man's Hole, Hays County, illustrating the amphitheatre-like appearance produced by the weathered Cow Creek beds.

Figure 10. Hamilton Pool, Travis County, another example of the unique type of weathering frequently witnessed in the Travis Peak.

Figure 11. West Cave, Travis County, illustrating the crescent shape of the waterfall caused by the weathering of the Cow Creek beds.

The topography of the Travis Peak formation is entirely different from that of the Glen Rose. Travis Peak hills are usually rounded; whereas, Glen Rose hills are ordinarily conical in cross section. Furthermore, upon weathering, Travis Peak strata usually form rolling land with a relatively smooth surface; whereas, the Glen Rose formation, due to the alternating character of the beds, presents a bench-like appearance making a rough and irregular topography.

STRATIGRAPHY

The Travis Peak formation consists principally of conglomerate, sand, and bluish shale in the lower portion, limestones in the middle, calcareous sandstone, marl, arenaceous limestone, and bands of conglomerate in the upper portion.

The Travis Peak formation records a subsidence of the land during its deposition. As the waters deepened, the deposits changed from coarse to fine materials, becoming more calcareous in the upper portion, the whole mass finally assuming a chalky appearance.

The deposition of Travis Peak sediments east of the Central Mineral region was rather uniform. The thickness of the formation varies according to the locality, although the general nature of the various phases in the different localities is the same. A conglomerate always represents the base of the Travis Peak, the Cow Creek beds or their equivalents are always present, and the red sands and sandy limestones above the Cow Creek beds are never lacking. In this respect, the similarity of sections in the different regions is remarkable.

In order that there may be no confusion in the interpretation of the divisions of the Travis Peak, each portion is considered in detail later.

North of Burnet County, the beds occupying the same stratigraphic position as the Travis Peak are in reality much younger in age and consequently the sediments are assigned to another formation because of the different characteristics which they possess. In northern Burnet County, the Travis Peak is entirely missing, the Walnut formation resting unconformably on the underlying Paleozoics. In central Burnet County, the Travis Peak is less than fifty feet in thickness. To the

southeast of Burnet County, the formation thickens decidedly, and at Austin, is represented by approximately 500 feet of sediments, as has been recorded in the log of a well drilled at the State Insane Asylum.

To the southeast, the Travis Peak maintains approximately the same thickness as at its type locality in northwestern Travis County, the sandy members becoming thinner and the limestone phase thicker. At Cox's Crossing, the total thickness of the beds assigned to the Travis Peak is approximately 260 feet, as compared to 263 feet at its type locality.

At Hammett's Crossing of the Pedernales River, about seven miles airline up the river from Cox's Crossing, only those sediments above the basal conglomerate are well exposed, this conglomerate being visible on the west bank of the river. The total thickness of the strata exposed in this region is approximately 217 feet. In an airline of about two miles from Hammett's Crossing, a complete section of the Travis Peak is well displayed in the vicinity of Dead Man's

Hole where the total thickness of the formation is 209 feet.

On Rebecca Creek, in western Comal County, the limestones of the middle Travis Peak and the sands of the upper portion have a total thickness of 120 feet. Strata below these limestones are not exposed at this locality.

At Speck's Crossing, Comal County, again only the middle and upper portions of the Travis Peak are exposed, the total thickness of these members being 118 feet. The clays, sands, and conglomerates below the limestones are not in evidence here.

A well drilled in the Leon Springs Reservation in Bexar County, starting in the Glen Rose formation, passed entirely through the Travis Peak and into the underlying schists. Alexander Deussen[5] has interpreted the bottom 480 feet of

---

[5] Sellards, E. H., Geology of Bexar County, University of Texas Bulletin 1932, pp. 21-22, 1919.

the strata of this well as being of Travis Peak age.

Hill has assigned the equivalents of the Travis Peak in the Fredericksburg region to the Gillespie formation. In that locality, these equivalents have a thickness of 175 feet. To the west and northwest of this area, the members of the Trinity Division gradually become thinner, until finally the Cretaceous-Pennsylvanian contact is between formations of the Fredericksburg Division and Pennsylvanian.

In order that details concerning the formation in different localities may be compared, various sections are given here for the sake of clarity.

It has already been suggested that the Travis Peak is divided into a number of members. These members are well illustrated by the section near the type locality of the formation. The following section, first measured by Taff,[6] inter-

---

[6]Taff, J. A., Cretaceous Area North of The Colorado River: Texas Geological Survey, Third Annual Report, p. 295. 1891.

polated by Hill,[7] and checked by the writer will give an idea of the relative sequence and composition of the beds:

"Hickory Creek Section of the Travis Peak Formation, beginning at the top of the divide between Hickory and Cow Creeks and continuing to the Colorado River level at the mouth of Hickory Creek, Burnet County.

	Thickness	Total depth to bottom of strata
Glen Rose Formation.		
Travis Peak Formation:	Feet	Feet
12. Bands of conglomerate and calcareous sandstone, alternating with beds of arenaceous limestone predominating	40	40
Hensell sand:		
11. Marly magnesian limestone	40	80
10. Calcareous sand at base, grading upward to a siliceous limestone at top, barren of fossils	55	135
9. Yellow calcareous sand, stratified . .	15	150
8. Conglomerate, similar in character to No. 2, with the exception that		

[7]Hill, R. T., Geography and Geology of the Black and Grand Prairies, Texas: U. S. Geological Survey, 21st Annual Report, Part 7, p. 141, 1901.

	Feet	Feet
pebbles are smaller and more worn, grading into sand below and into calcareous sand above . . .	25	175
7. Red sand, unconsolidated .	3	178
6. Friable, yellow sand . .	5	183
Cow Creek beds:		
5. Cross-bedded shell breccia, containing many small rounded grains and pebbles of quartz flint and granite sand. Fossils: Trigonia and small bivalves and Ammonites justinae . .	7	190
4. Ostrea beds, magnesian lime cement, fossils en masse	3	193
3. Brecciated grit, composed of worn fragments of oyster shells and shells of other Mollusca, with sand and fine pebbles stratified in false beds	5	198
2. Bands of friable bluish shale, and calcareous sand, stratified. Fragments of oyster shells are common in the calcareous sandstones . . .	15	213
Sycamore sands:		
1. Basal conglomerate of pebbles of limestone, quartz, chert, granite, and schist, well-rounded in a cement of ferruginous yellow and red gritty sand. Some of the pebbles at the base		

	Thickness	Total depth to bottom of strata
	Feet	Feet
are from 4 to 6 inches in diameter. They decrease in size, however, upward from the base, until we obtain a false-bedded calcareous shell grit at the top	50	263
Carboniferous:		
O. Laminated, flaggy, Carboniferous sandstones and friable light-blue clay of Carboniferous (Coal Measures) age, from the Colorado River level upward to the base of the Trinity conglomerate, the laminated sandstones containing prints of ferns, nearly	100	363 "

Section of Travis Peak in the vicinity of Cox's[8] Crossing of the Pedernales River, Travis County:

	Feet
Section as exposed about five miles west of Cox's Crossing:	
Glen Rose:	
Limestone, hard, arenaceous, cream colored, with fragments of Toucasia	
Travis Peak:	
Limestone, hard, arenaceous, to conglomeratic, cream colored	3

[8] Aneroid barometer measurements.

	Feet
Sands and variegated clays mostly yellow to blue, sometimes thin, calcareous sandstones scattered through upper portion	77
Total sands, clays, sandstones, and limestones, approximately	80

Section along banks of Pedernales River at Cox's Crossing:

Cow Creek beds:	
Limestones, hard, massive, cream colored, with shell breccia, contains many fossils about same as on Cow Creek	56
Sycamore sands and clays:	
Sands and variegated clays, covered for the most part . .	93
Basal Conglomerate:	
The top of the conglomerate is exposed on the bank of the Pedernales River upstream from Cox's Crossing about one-half mile. It has the same characteristics there as in other localities. All of the conglomerate was covered with the exception of the top few feet .	
Total Thickness exposed at Cox's Crossing	229

Section of Travis Peak in the vicinity of Hammett's Crossing of the Pedernales River, Travis County:

	Feet
Section on hill east of Hammett's Crossing:	
Glen Rose:	
Limestone, hard massive, cream colored.	
Travis Peak:	
Hensell sands or equivalents:	
Limestone, arenaceous, grayish in color	14
Sands and clays, yellowish or cream colored	8
Limestone, arenaceous, yellowish to cream colored	2
Sands and clays, yellowish to cream colored	25
Sands and clays, cream colored to gray in color at top of which is harder layer giving bench-like appearance	30
Total thickness of sands and clays above Cow Creek beds	79

Section at Hammett's Crossing; better exposed at Hamilton Pool:

Cow Creek beds:

	Feet
Limestone, heavy bedded, containing many fossils	45
Limestone with an abundance of Ostrea franklini Coquand . .	13
Limestone, softer, fossils about the same as on Cow Creek	18
Total Thickness of limestones . . .	76

Section at Hammett's Crossing:

Sycamore sands or equivalents: Sands and variegated clays, the lower part of which is covered . .	62
Basal conglomerate, consisting of about the same materials as at the type locality, is covered, with the exception of the top, which may be seen at the west end of the bridge at Hammett's Crossing	
Total section of Travis Peak exposed . .	217

Section of Travis Peak as exposed at and near Dead Man's Hole, Hays County:

Glen Rose:

Limestone, hard, cream colored containing fragments of Toucasia . . .	

	Feet
Travis Peak:	
Sands, coarse grained, yellowish-white in color; shell breccia also present	72
Limestone, hard, massive, gray to white, equivalent to Cow Creek beds, very fossiliferous	65
Clays and sands, cream colored to red in appearance, forming banks of creek draining Dead Man's Hole, mostly covered material	30
Conglomerate, similar to that at type locality, containing many pebbles of various sizes, made up of fragments of Paleozoic and igneous materials consisting of limestones, quartz, granites, schists, gneisses, and red sands. The upper portion of the conglomerate grades into a red sandstone which has a thickness of from 3 to 5 feet. Total thickness of conglomerate and sandstone	42
Total thickness of Travis Peak in the vicinity of Dead Man's Hole . .	209

Section of Travis Peak as exposed on Rebecca Creek, four and one-half miles airline northeast of Spring Branch, Comal County:

	Feet
Glen Rose:	

	Feet
Limestone, hard, massive, yellowish in color, containing fragments of Toucasia	
Travis Peak:	
Sands, cream colored to yellow, frequently calcareous, containing an abundance of geodes and a number of large specimens of Ostrea bullardi sp. nov. . . .	45
Limestone, frequently arenaceous gray to white, equivalent to Cow Creek beds; very fossiliferous in zones. Upper portion contains magnesium sulphate. Total thickness about	75
Total thickness of Travis Peak beds exposed on Rebecca Creek approximately	120

Section of upper Travis Peak as exposed on north side of the Guadalupe River about three-fourths of a mile up stream from Speck's Crossing, Comal County:

	Feet
Glen Rose:	
Hard, massive limestone, karrenfelder weathering, very fossiliferous, containing specimens of Trigonia, Arctica, Nerinea, etc.	
Travis Peak:	
Limestone, cream colored and	

	Feet
very sandy	12
Sands, yellowish, containing geodes	28
Limestone, arenaceous, very fossiliferous, Equivalents of the Cow Creek beds . . .	78
Total thickness of Travis Peak exposed at this locality . .	118

In order that variations in thickness of the members of the formation may be easily compared, a table is included here to show these differences, according to locality, Table III. These thicknesses are also shown in columnar form in Figure 12.

TABLE III.

VARIATIONS IN THICKNESS OF MEMBERS OF TRAVIS PEAK
ACCORDING TO LOCALITIES

Division	Hickory Creek	Cox's Crossing	Hammett's Crossing	Dead Man's Hole	Rebecca Creek	Speck's Crossing
Upper conglomerate, sandstones and sandy limestones	40	80*	79	72	45	40
Hensell sands or their equivalents	143					
Cow Creek beds, (Limestone member) or their equivalents	30	56*	76*	65	75	78
Sycamore clays and sands or their equivalents	50	93*	62*	30	not exposed	not exposed
Basal conglomerates		mostly covered	covered	42	not exposed	not exposed
Total thickness exposed	263 complete section	229 exposed	217 exposed	209 complete section	120 exposed	118 exposed

* Aneroid barometer measurements

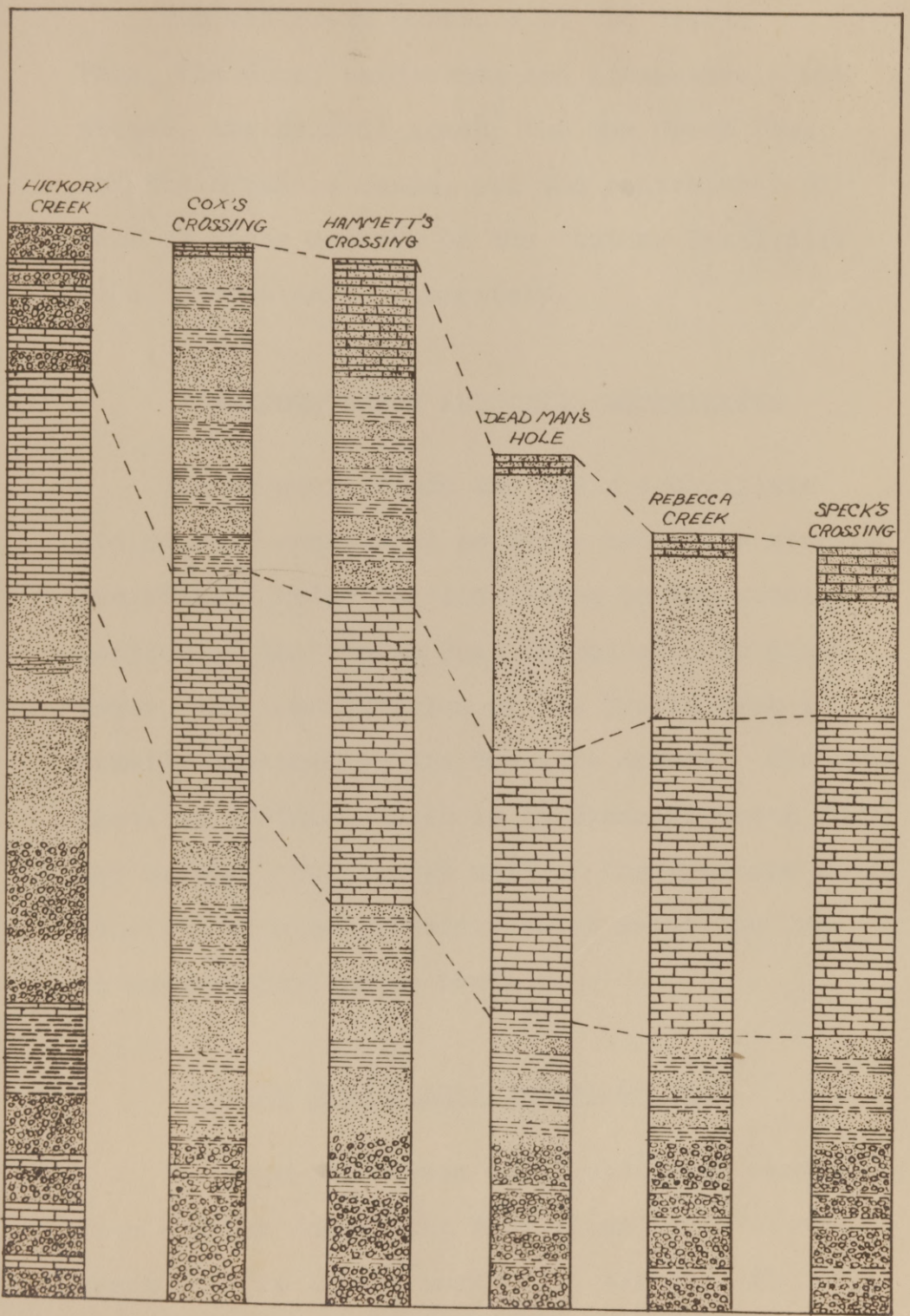


Figure 1a. Correlation Chart of Sections.

The different portions of the Travis Peak, the upper sandstones and arenaceous limestones, the Hensell sands, the Cow Creek beds, and the Sycamore sands, and the equivalents of each of these members in the various localities will be considered separately.

SYCAMORE SANDS AND THEIR EQUIVALENTS

The Sycamore sands and their equivalents are usually considered as those sediments stratigraphically below the limestones in the middle portion of the Travis Peak formation. In other words, the lower portion of the Travis Peak is usually assigned to the Sycamore member. The type locality of this member is on Sycamore Creek, Burnet County. The lowest unit of the Sycamore sands consists of a conglomerate which marks the Cretaceous-Pennsylvanian contact.

Travis Peak-Pennsylvanian Contact

The contact between the Travis Peak formation and the underlying Pennsylvanian is by no means uniform in its horizontal extent. The char-

acter of the contact varies according to the change in locality. There are certain conditions which seem to prevail; for example, there is always necessarily an unconformity between the basal beds of the Cretaceous and the underlying Pennsylvanian. The absence of Permian, Triassic, and Jurassic sediments in this region is noteworthy.

It is to be concluded, after making a study of the conditions under which the Travis Peak was deposited, that the old Paleozoic floor of the Trinity sea must have been very irregular. This accounts, in part, for the variations in thickness of the sections. This phenomenon seems to be general regardless of whether the formation is observed at the surface or encountered in wells.

Similar to most of the Cretaceous-Pennsylvanian contacts, a conglomerate occurs at the base of the Travis Peak. This conglomerate consists of an accumulation of different sizes of boulders and pebbles of varied compositions. Usually pieces of Paleozoic lime-

stones, particularly Ellenburger and Marble Falls, cherts, granites, schists, and quartz are found. The sizes of the gravels composing the conglomerate vary in size, shape, and angularity, according to the locality under consideration. The source of the sediments composing the Travis Peak formation was doubtless the Central Mineral Region, as is well illustrated by the basal conglomerate. The granites and quartz materials were derived from the igneous rocks which were distributed throughout the Central Mineral Region. The schists are derived from the Packsaddle formation, and the gneisses from the Valley Spring Gneiss. These are the main constituents of the basal conglomerate, although other materials are found in small quantities. The conglomerates higher in the Travis Peak section are usually composed of much smaller particles than those found in the basal conglomerates.

The following photographs show the contact between the Travis Peak formation and the Pennsylvanian:

Figure 13. Travis Peak-Smithwick contact near the mouth of Hickory Creek, Burnet County.

Figure 14. The basal conglomerate directly above the Travis Peak-Smithwick contact, Hickory Creek, Burnet County.

The variation in size of the pebbles and boulders in the basal conglomerate is significant. The thickness of the conglomerate and the size of the stones in the matrix furnishes direct information regarding the relative position of the old land mass which supplied the sediments, as well as the probable distance of the land from the Travis Peak sea. The basal conglomerate, together with the coarse sands and red sandstones of the Sycamore member have a thickness of about 50 feet in Burnet County. These sediments tend to thicken southward, having a thickness of about 490 feet[10] at Austin, 125 feet at Cox's Crossing, 100 feet at Hammett's Crossing, and 72 feet at Dead Man's Hole. The Sycamore beds do not outcrop in Comal County, but in well sections are found to have a thickness of about 65 feet.

At the type locality, the conglomerate consists of pebbles and boulders ranging from a coarse grit to about eight inches in diameter.

---

[10] Hill, R. T., Geography and Geology of the Black and Grand Prairies, Texas. U. S. Geological Survey, 21st Annual Report, Part 7, p. 509. 1901.

East of Spicewood, the basal conglomerate outcrops again, the boulders being as large, or larger, than those in Burnet County. The top of it is also visible a short distance south of Cox's Crossing, in the bed of the Pedernales River, and again at Hammett's Crossing on the west bank of the river near the bridge. The thickness of the conglomerate near the mouth of the creek draining Dead Man's Hole is 42 feet.

A sandy clay, which is included in the 50 feet of sediments situated below the Cow Creek beds at the type locality, directly overlies this conglomerate. This clay thickens between the type locality and Cox's Crossing and persists southward, following along the Pedernales River to Hammett's Crossing where it has a thickness of 62 feet. These clays again outcrop along the Pedernales River, and at the mouth of the creek draining Dead Man's Hole, they are 30 feet in thickness. Due to structural conditions, there are no good outcrops

of these beds in southern Hays or Comal counties.

The following photographs illustrate the lithology of the Sycamore member:

Figure 15. The Sycamore member, as exposed about three miles west of Cox's Crossing, Travis County.

Figure 16. Calcareous grit of the upper portion of the Sycamore member of the Travis Peak as exposed near the mouth of Hickory Creek, Burnet County.

COW CREEK BEDS AND THEIR EQUIVALENTS

The term "Cow Creek beds" is applied to the limestones forming the middle portion of the Travis Peak formation. They are typically exposed on Cow Creek above the junction of Postoak Creek,

in northwestern Travis County. These beds are easily distinguishable from those in other parts of the formation because of their lithologic characteristic and the abundance of fossils contained in them. Generally, the limestones are hard, massive, and grayish-white to cream colored. The upper portion of the member is often dolomitic. At the type locality on Cow Creek, the limestones have a total thickness of thirty feet. As a whole, they tend to thicken southward, the fossiliferous beds, however, maintaining approximately the same thickness as those on Cow Creek. In addition to becoming thicker to the south, the limestones become arenaceous. Many of the fossils found at the type locality of the Cow Creek beds occur in the southern outcrops of this member.

The gradual thickening of the Cow Creek beds and their equivalents southward is illustrated by a comparison of the thicknesses at various localities. At Cox's Crossing, the thickness of this member has increased from thirty feet at the type locality to 56 feet. These beds are

well exposed along the bluffs of the Pedernales River south of Cox's Crossing. About five miles west of Cox's Crossing, in Burnet County, the upper Cox Creek beds are exposed in a creek on the north side of the Austin-Marble Falls highway. Fossils are found in profusion at this locality. About two miles southeast of Cox's Crossing, the Cow Creek beds are again well exposed on Mr. Milam's place. This is another good locality for collecting fossils.

The Cow Creek beds outcrop along the course of the Pedernales River, at and between Cox's Crossing and Hammett's Crossing. These beds form the bluffs along the banks of the river. The strata are well exposed, also, at West Cave, one-half mile west of Hammett's Crossing, and at Hamilton Pool, on Hamilton Creek, about one and one-fourth miles east of the crossing. Both of these localities are scenic spots which have been caused by the peculiar weathering of the Cow Creek beds in large amphitheater-like holes.

The Cow Creek beds also outcrop along the

Pedernales River from Hammett's Crossing into Hays County, thence southward to Dead Man's Hole, where the strata are beautifully exposed. This is an excellent locality for making fossil collections. To the south of Dead Man's Hole, the outcrops are interrupted by structural conditions, chiefly faults. Perhaps the best outcrop of the middle portion of the Travis Peak south of the vicinity of Dead Man's Hole is on Rebecca Creek, in northwestern Comal County, where the Cow Creek beds or their equivalents have a total thickness of about 75 feet, or possibly a little more. The same beds outcrop at Speck's Crossing, on the Guadalupe River, where they have a thickness of about 78 feet. A large number of the fossils which are found in the Cow Creek beds at the type locality are represented at these localities in Comal County. The general nature of the beds is about the same throughout the horizontal extent of the formation except for the gradual thickening to the south and for the arenaceous char-

acter which they assume in that direction. The following photograph illustrates the Cow Creek beds as exposed at their type locality on Cow Creek:

Figure 17. Massive Cow Creek beds exposed at the type locality on Cow Creek, Travis County.

HENSELL SANDS AND THEIR EQUIVALENTS

The term "Hensell sands" is applied to the sands, sandy clays, sandstones, arenaceous limestones, and conglomerates which compose the upper portion of the Travis Peak formation. They were named in honor of Mr. Hensell, whose house is the Travis Peak post-office, in northwestern Travis County. This member of the Travis Peak formation is typically exposed at this locality. It is not difficult to distinguish from other parts of the formation because of its lithologic character and its position directly above the Cow Creek beds, which are always easy to locate stratigraphically. Generally, the sands are cream colored to reddish, and are frequently calcareous. In the upper portions, they grade into sandstones and arenaceous limestones. Frequently beds of conglomerates and clays are found interstratified with them. The uppermost beds of the Travis Peak are considered in the discussion of the Glen Rose-Travis Peak contact.

At the type locality of the Hensell sands, they have a thickness of 143 feet, above which are 40 feet of conglomerates, sandstones, and sandy limestones. The thickness of this member varies in the horizontal extent of the formation because of the nature of the sediments and the conditions under which they were deposited. They have a tendency to thin southward from the type locality. At Cox's Crossing, the sediments above the Cow Creek beds have thinned from 183 feet at the type locality to 80 feet. They are well exposed about five miles west of Cox's Crossing south of the Austin - Marble Falls highway. There is another good outcrop of this member of the Travis Peak on Mr. Milam's place about two miles southeast of Cox's Crossing, where it has about the same thickness. The same sediments outcrop along the hills on each side of the Pedernales River intermittently between Cox's Crossing and Hammett's Crossing. On top of the bluff, formed by the Cow Creek beds, on the east side of the river at Hammett's Crossing,

the sands and sandy clays have a total thickness of 79 feet. These sands are again exposed on the Cypress Mill - Austin highway between the crossing of Hamilton Creek and Shingle Hills, where the section is approximately the same as at Hammett's Crossing. At Dead Man's Hole, Hays County, the thickness of the sandy material corresponding to the Hensell sands is 72 feet, at the top of which the Glen Rose - Travis Peak contact is very evident. The base of the Glen Rose is marked by the presence of the genus Toucasia, otherwise the change from the Glen Rose to the Travis Peak is almost imperceptible.

In Comal County, there are several good outcrops of the upper sands, which are equivalent to the Hensell sands. Along Rebecca Creek, they have a thickness of approximately 45 feet. In this region, this portion of the Travis Peak is marked by the presence of geodes, ranging from two to ten inches in diameter, which are often found in abundance covering the weathered surface of the sands. Insofar as is known, the presence of this particular type of geode,

(Plate XXV), is restricted to the upper portion of this formation, and it is doubtful whether they will be found in any other formation in the abundance in which they occur in the Travis Peak. Another good outcrop of geodes occurs in the same stratigraphic position along the New Braunfels - Blanco highway at the junction of the first Spring Branch road west of New Braunfels. On top of the bluff on the north bank of the Guadalupe River, at Speck's Crossing, the sandy material between the Cow Creek beds and the Glen Rose has a thickness of 40 feet. The rapid thinning of the upper sands from 183 feet in Burnet County to 40 feet in Comal County is noteworthy. The following photographs show the lithology and general nature of this member of the Travis Peak:

Figure 18. Hensell sands and clays exposed on Hickory Creek, Burnet County.

Figure 19. Arenaceous limestone, calcareous sandstone, and conglomerate as found in the uppermost beds of the Travis Peak, as exposed on Hickory Creek, Burnet County.

Glen Rose-Travis Peak Contact

Similarity in the stratigraphy of the Glen Rose and Travis Peak formations often causes difficulty in locating the contact between the two. The character of the contact between the Glen Rose and Travis Peak formations is not always the same. In the normal succession of beds from the upper Travis Peak to the lower Glen Rose, trouble arises in distinguishing them because of lithologic similarities; the arenaceous limestones and calcareous sandstones of the upper Travis Peak grading into the arenaceous limestones of the lower Glen Rose. Due to this likeness, well drillers have difficulty in separating the two formations. Another factor which makes the separation of the formations even more difficult, is that the Travis Peak outcrops within the Balcones Fault Zone, frequently faulting the lower Glen Rose against the upper Travis Peak and resulting in the displacement of the contact.

As the contact is traced from its outcrop in southeastern Burnet County to western Comal County, the general character of the upper Travis Peak remains the same. An arenaceous limestone is usually present in the uppermost portion of the formation. Ordinarily, this bed is about two feet in thickness and is the result of a uniform deposition of sediments. Because of this uniformity in deposition of the uppermost portion of the Travis Peak, the conclusion is drawn that the basal beds of the Glen Rose are the ones which changed in character. This condition doubtless existed. In Comal County, the Glen Rose is approximately 740 feet thick. To the north in Burnet County, it is only about 300 feet in thickness. The thinning of this formation to the north is gradual, and may be explained as being due to a progressive overlap of the Glen Rose sea, in which the lower beds of the formation were not deposited as the sea progressed to the north and west. The base of the Glen Rose in Burnet County corresponds to approxi-

mately the middle of the section in Comal County. It is the constant changing of the lower beds of the Glen Rose, therefore, which makes the separation of the two formations difficult.

Hill[11] defines the Glen Rose -Travis Peak contact by the statement that "the lowest appearance of the fossils Monopleura and Requienia indicates the beginning of the Glen Rose." The writer has collected from various outcrops of the Travis Peak formation and has found that frequently this definition has been a good one. In Comal County, however, other limestone beds containing corals and cephalopods occur in the base of the Glen Rose.

The writer has found that the best way in which to determine the Glen Rose - Travis Peak contact is to locate the Cow Creek beds, then go up in the section through the Hensell sands until hard limestones, which are neither conglomeratic nor exceedingly arenaceous, are encountered. Ordinarily, these beds are the lowermost strata of the

---

[11]Hill, R. T.: Geography and Geology of the Black and Grand Prairies, Texas, U. S. Geol. Survey, 21st Annual Report, Part 7, p. 144, 1901.

Glen Rose.

At the Hickory Creek section of the Travis Peak, the uppermost beds consist of sands, arenaceous limestones, calcareous sandstones, and conglomerates. Directly above the topmost conglomeratic limestone of this formation, occurs a hard massive, cream colored limestone above which occur alternating beds of limestone and clays. This cream colored limestone marks the beginning of the Glen Rose beds.

Another contact of the Glen Rose and Travis Peak occurs along the Austin - Marble Falls highway and may be observed on the hill just above the gate on the road to Mr. Milam's place. At this locality, the basal Glen Rose is marked by the presence of Monopleuras and Toucasias and an abundance of Orbitolina texana Roemer.

The Glen Rose - Travis Peak contact is again exposed about five miles west of Cox's Crossing on the south side of the Austin-Marble Falls highway. At this locality, the upper Travis Peak is very sandy and conglomeratic, whereas, the basal bed of the Glen Rose is a hard, massive, lime-

stone containing fragments of Toucasias. Stratigraphically this layer is only about five feet above a conglomerate in the upper Travis Peak. The contact of the Glen Rose and the Travis Peak formations between Hamilton Pool and Shingle Hills has essentially the same characteristics.

In general, it might be said that the Travis Peak is sandy throughout, whereas, the Glen Rose is sandy only in certain phases. The Travis Peak sands are usually coarse, whereas those of the Glen Rose are fine. The Travis Peak is conglomeratic, whereas the Glen Rose contains no conglomerates.

The following photographs show the Glen Rose - Travis Peak contact:

Figure 20. Glen Rose-Travis Peak contact as exposed on the east bank of Hickory Creek, Burnet County.

Figure 21. Glen Rose-Travis Peak contact as exposed about five miles west of Cox's Crossing, Burnet County.

Figure 22. Glen Rose - Travis Peak contact as exposed at Spring Branch, Comal County.

ECONOMIC GEOLOGY

The Travis Peak formation is relatively unimportant economically. It has probably fewer possibilities of becoming of economic value than any of the other formations in the Cretaceous of central Texas. Almost all of the other formations of the Cretaceous contain something of value, either in the form of building stone, road building material,

carving stone for ornamental purposes, gravels, cement, brick clay, oil, or minerals. At present, the Travis Peak produces nothing of this kind.

The formation is an extensive reservoir for water, this being at present its most important asset. Not all of the water derived from the Travis Peak is desirable for drinking purposes, due to the presence of Epsom salts, $MgSO_4$, in some parts of the formation in various localities. The Travis Peak is characterized by many springs, and has proved to be a prolific source of artesian water along the Balcones Fault Zone in the area including Travis, Hays, Comal, and Bexar counties. Barton Springs at Austin, Roger's Park at San Marcos, Landa Park at New Braunfels, along with several other springs in this zone, derive their water from the sands of the Travis Peak formation.

The rock from the Travis Peak formation is not suitable for use as building stone. It is probably too soft and porous, and does not have

sufficient strength to be utilized for this purpose. If the limestone could be adapted for this purpose, difficulties would arise in transporting it due to the inaccessible locations of the outcrops. Portions of the Cow Creek beds are sufficiently fossiliferous to be used for ornamental building stone, although the stone in the Walnut and Edwards formations is equally beautiful, after being dressed, and is much softer and easier to carve. Moreover, the latter is situated where there are better transportation facilities. Because of the competition which the Walnut formation and the Austin marble of the Edwards would provide, it is not feasible to consider the Travis Peak in this connection.

It is possible to use the limestone in the middle portion of the Travis Peak as crushed rock for road material, although, if it were utilized in this way, it would be only for local purposes, because of its inaccessibility. The Edwards and other limestones provide much better sources of this material than the Travis Peak and

and because of more advantageous locations, would prohibit the extensive use of Travis Peak as crushed rock for commercial purposes.

Both sands and clays are present in the upper portions of the Travis Peak, although the sand is not sufficiently pure for commercial development, and the clays are not suitable for the manufacture of brick or tile, and are therefore, unfit for practical consideration, other than usage as road building materials in local areas.

Calcite, Epsom salts, pyrite, marcasite, limonite, and other minerals are found scattered through the formation, although they are of no importance economically. Iron is responsible for the presence of the red and yellow colored clays, sands, and sandstones in the formation.

Although at present the Travis Peak produces no petroleum, it might prove to be an excellent source rock, if encountered under favorable conditions. The presence of sands in the upper and lower portions of the formation and the often porous Cow Creek beds in the middle part, indicate that the formation could easily

serve as a storage place for oil. Although the Travis Peak is not known to contain "source rocks" which could provide petroleum, the formation would serve as a good reservoir for oil which might migrate into it from the underlying paleozoics. This possibility has not been thoroughly exploited and there are many chances that oil might be encountered in the formation. Success in this respect would render the formation of great economic importance.

The presence of conglomerates, limestones, and sandstones render most of the soils produced by the Travis Peak unfit for agricultural purposes. Those portions of the formation containing sands, clays, and marls, however, produce soils which are poor, but are utilized for farming.

PALEONTOLOGY

The paleontology of the Travis Peak in this region has been less studied perhaps than any of

the other Cretaceous formations. There are numerous reasons for this lack of investigation. Ordinarily the fossils present in the Travis Peak are in zones and are limited rather than distributed generally throughout the formation. Even in these zones, it is only rarely that the actual shells of the fossils are preserved. There is usually some difficulty in identifying the Travis Peak fossils because of their state of preservation, which usually results in the absence of the surface ornamentation and other characteristics which are used in taxonomic work. Most of the fossils are in the form of casts or molds and are fragmentary, and are usually very difficult to remove from the rocks. Very frequently they are preserved in the form of calcite pseudomorphs, and are easily broken or weathered. The absence of dentition in many of the casts makes it particularly difficult to determine even the genus of many of the specimens. In identifying casts of pelecypods, use is made of such characteristics as size, shape of cast, position and character of

the beaks, character of margins, presence and nature of muscle scars, presence or absence of pallial line, character of lunule if it is present, degrees of umbonal slopes, amount of inflation of the cast, and any ornamentations which may be reflected. In identifying casts of gastropods, use is made of such characteristics as size and shape, apical angle, sutural angle, number, size, and character of volutions, size and nature of body whorl, nature of the aperture, and any surface ornamentations which may be present.

The paleontology of the Travis Peak has not been studied heretofore in detail also because of the localization of the outcrops of the horizon which contains most of the fossils. These outcrops are very narrow and have a limited horizontal distribution. They are usually more or less isolated places and even after reaching them, it is difficult to collect specimens worthy of identification. Many of the Travis Peak fossils have been des-

cribed from the equivalents of the formation in other regions.

Still another reason why the Travis Peak, in general, has not been studied more fully is that the formation is relatively unimportant economically.

Perhaps the first paleontologist to describe any of the Travis Peak fossils was F. Roemer.[12] T. A. Conrad[13] next recorded fossils of Travis Peak age, although the fossils were not collected in this region, but from Travis Peak equivalents to the west. F. W. Cragin[14] has studied the paleontology of the Travis Peak

---

[12] Roemer, F.: Die kreidebldungen von Texas, und ihre organischen Einschullusse, Bonn, 1852.

[13] Conrad, T. A.; Report of the United States and Mexican Boundary Survey, Volume I, 1857.

[14] Cragin, F. W.: Invertebrate Paleontology of the Texas Cretaceous, Texas Geological Survey, Fourth Annual Report. 1893.

in more detail than any other writer. R. T. Hill[15] has described several forms from the Travis Peak and from the Trinity Division in Arkansas. He has probably given us more general information regarding this formation than any other person.

The fossils in the Travis Peak are not generally distributed, but occur in definite zones. By far, the majority of them occur in the Cow Creek beds or in the shell breccias in the middle of the Travis Peak. Directly below the Cow Creek beds, in the Sycamore sands and clays, a few fossils are usually found. Above the Cow Creek beds, in the Hensell sands, near the top of the Travis Peak, a few fossils are present.

The lower fossil bed, or the bed below the Cow Creek horizon, contains only a few species, which occur rather uniformly in the same position. In this zone, Ostrea franklini Coquand and Exogyra hilli Cragin, and E. weatherfordensis Cragin are present. This zone is char-

---

[15]Hill, R. T.: Cretaceous Rocks of Texas and their Economic Uses, Geol. Survey of Texas, First Annual Report, p. 118. 1889.

acterized by a scarcity of species.

The zone in the Travis Peak in which fossils are most abundant is in the Cow Creek beds, especially in the upper portion. The species occurring in this horizon seem to be consistent in their horizontal distribution, although vertically their ranges are rather limited. In this horizon, there is frequently a profusion of Astarte pikensis (Hill) and Cyrena arkansasensis Hill. Along with these species, there occurs a multitude of other forms. Molluscs make up practically the entire fauna of this zone.

The following fossils occur in the Cow Creek beds:

Corals:

Orbicella travisensis Wells
Siderastrea cuyleri Wells

Pelecypods:

Nucula tharpi sp. nov.
Cucullaea gracilis Cragin
Cucullaea hamletti sp. nov.
Cucullaea sellardsi sp. nov.
Cucullaea terminalis Conrad
Avicula eifleri sp. nov.
Avicula whitneyi sp. nov.
Ostrea camelina Cragin
Ostrea franklini Coquand
Ostrea alternans Cragin
Ostrea estherae sp. nov.
Trigonia concentrica Cragin

Trigonia hilli sp. nov.
Trigonia whitneyi sp. nov.
Neithea sp.
Pholadomya aff. gigantea (Sowerby)
Anatina brilli sp. nov.
Liopistha jurafacies (Cragin)
Arctica mcallisteri sp. nov.
Arctica medialis (Conrad)
Arctica roemeri (Cragin)
Astarte pikensis (Hill)
Remondia wellsi sp. nov.
Cyrena arkansasensis Hill
Cardita browni sp. nov.
Phacoidea potosina Castillo and Aguilera
Protocardia goffi sp. nov.
Protocardia multistriata Shumard
Protocardia aff. sphaeroidea (Forbes)
Cyprimeria whitneyi sp. nov.
Meretrix stantoni sp. nov.
Ptychomya wellsi sp. nov.
Panopea solcheri sp. nov.
Panopea pattoni sp. nov.

Gastropods:

Turbo konzi sp. nov.
Turbo aff. munitus Forbes
Natica travisensis sp. nov.
Tylostoma simondsi sp. nov.
Tylostoma bullardi sp. nov.
Anchura simondsi sp. nov.
Anchura travisensis sp. nov.
Aporrhais ? deeni sp. nov.
Aporrhais henryi sp. nov.
Turritella sp.
Turritella travisensis sp. nov.
Nerinea texana Roemer

Cephalopods:

Dufrenoya roemeri (Cragin)
Dufrenoya aff. dufrenoyi (d'Orbigny)

In the upper portion of the formation, or Hensell sands, there are a few species which occur

in abundance, but the number of species occurring in this zone is much smaller than in Cow Creek beds. This zone of fossils occurs about 15 feet below the top of the Travis Peak. Among those fossils present are:
Exogyra bullardi sp. nov., Ostrea whitneyi sp. nov., and Orbitolina texana (Roemer).

There is an exceptionally close relationship between the fossils of the Travis Peak and the Glen Rose formations. In fact, with the exception of a few of the forms in the Travis Peak, the same fossils occur in both formations. This phenomenon was doubtless caused by the changing depths of the water during the time of deposition of the Travis Peak sediments. Such forms as Arctica roemeri (Cragin), Cucullaea gracilis Cragin, Cucullaea terminalis Conrad, Alectryonia alternans (Cragin), Arctica medialis (Conrad), Protocardia multistriata (Shumard), and Protocardia sp. aff. sphaeroidea (Forbes), occur as abundantly, or perhaps more so, in the Glen Rose than in the Travis Peak.

This repetition of Travis Peak fauna in the Glen Rose was doubtless a result of the migration

of the fauna between the time of deposition of the Cow Creek beds and the Glen Rose alternating beds, or during the time of deposition of the Hensell sands. This change in conditions in the water at that time permitted only a few of the forms, which were able to adapt themselves to these conditions, to remain.

Undoubtedly upon further investigation and collecting, the vertical ranges of many of these fossils will be more accurately determined. A careful comparison must be made with the Glen Rose fauna before any definite conclusions can be obtained regarding the absolute ranges of any of these forms. The writer does not attempt to limit any of the species in regard to the horizontal distribution. A great deal of careful collecting must be conducted before any definite ideas can be reached in this respect.

There seems to be a great variation within some of the species in the Travis Peak. The writer has not attempted to describe any of these close variations as new species. For this reason the sizes and measurements given in the descrip-

tion of the species are not expected to hold generally except in the form of ratios. The measurements of the types are given in order to give a relative idea in regard to sizes and proportions of the species. O. franklini Coquand provides an excellent example of variations within species. Some forms of O. franklini are narrow and elongate, whereas others are elongate and wider; these grade into short, rounded and flattened shells. All of the intermediate stages between these gradations are present. The cartilage pit in each case, however, has the same characteristics. Other distinguishing features are also traceable throughout the series. Variations within other species, especially in the genus Ostrea, are also as prominent as those exhibited in O. franklini.

To date, neither brachiopods nor echinoids have been found in the Travis Peak, although echinoid spines have been observed in thin sections of the formation. There is no reason to believe that these will not be found upon furthere collecting. Fucoids are present occasion-

ally throughout the formation, but are not in abundance.

The presence of Orbitolina texana (Roemer) is notable. Heretofore, the presence of this species has been limited to the Glen Rose. In the upper Hensell sands, about four miles west of Cox's Crossing, at a point approximately seventeen feet below the top of the Travis Peak, this species occurs in profusion. The specimens vary greatly in size, have rolled margins and are more siliceous than those in the Glen Rose. The silica is doubtless due to the occurrence of these specimens in the sandy material in the Travis Peak, whereas, in the Glen Rose, they are ordinarily found in more calcareous material. At first the species was thought to be new, but upon comparison with the Glen Rose form of O. texana, they were found to be the same.

A few fragments of undeterminable shells were found.

One of these appears to be a species of Solen.

Fossils of the Travis Peak have been compared with those of Europe and have been found to be of Aptian age. The equivalent in England is that of the Lower Greensand. In Europe, practically the same genera are represented in these equivalents as in the Travis Peak of Central Texas, although the species are, for the most part, different. In Mexico, the same genera and species are found in the Aptian as in the Travis Peak. The writer has not attempted to correlate any of these equivalents on the basis of any single genus or species, but instead has used the general faunal aspect. He believes that the complete fauna will give a more representative criterion for correlation than a few genera.

Explanations of Descriptions -- A careful study has been made of all of the literature available on the Travis Peak formation. For completeness, all of the species involved in this paper are described and illustrated. Whenever one redescribes an established species, there is a chance for misinterpretation and possible oversight of salient characteristics, hence, the wri-

ter prefers using the original description whenever feasible.

The most typical specimens of the new species have been selected as types and have been deposited with the Department of Geology, The University of Texas.

The measurements of the specimens cannot be used as the absolute and only size represented by the species. In many cases, the number of specimens collected is small and for this reason, combined with the fact that most of them are casts, makes for difficulty in identification.

Zittel's classification in his Textbook of Paleontology, 1913, has been used in the consideration of the Pelecypoda and Gastropoda. Cushman's classification in his Foraminifera, their Classification and Economic Use, 1928, was used in placing the genus Orbitolina. Corals were classified according to T. Wayland Vaughan, Bulletin U. S. Natural Museum, No. 103, 1919.

DESCRIPTION OF SPECIES

PROTOZOA

RHIZOPODA

FORAMINIFERA

ORBITOLINIDAE

Genus ORBITOLINA d'Orbigny 1847

Orbitolina texana (Roemer)

Pl. I, Fig. 1.

1849. Orbitulites texanus Roemer, Texas, Bonn., p. 392

1852. Orbitulites texanus Roemer, Kreide von Texas, Bonn., p. 86, Taf. 10, figs. 7a-d.

1893. Patellina texana Hill, The Invertebrate Paleontology of the Trinity Division, Proc. Bio. Soc. Wash., p. 20, pl. I, figs. 2, 2a, 2b, 2c, 2d.

1926. Orbitolina texana Carsey, Foraminifera of the Cretaceous of Central Texas, Univ. of Tex. Bull. 2612, p. 33, pl. 6, figs. 6a, 6b, 6c.

1928. Orbitolina texana (Roemer) Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Tex. Bull. 2838, p. 61.

Test slightly elevated to flat, sub-circular to circular in outline, polythalamous, surface smooth or with fine concentric lines of growth, shell convexo-concave, dorsal side rounded or conical; ventral side concave or flattened; peripheral margin thickened, rolled towards dorsal side or ventral side.

Measurements: Diameter varies up to about 9 mm., usually averaging around 5 to 7 mm. The Travis Peak form of O. texana is usually much smaller, averaging around 5 mm., but may be smaller, or much larger.

Occurrence: Four miles west of Cox's Crossing, Burnet County, specimens of O. texana were found in profusion in the Hensell sands 17 feet below the Travis Peak-Glen Rose contact. O. texana has heretofore been regarded as being of Glen Rose age only, although there is no doubt as to the stratigraphic position of this species in the Travis Peak as well. Due to the presence of these foraminifera in sandy material, the tests are more arenaceous than the calcareous forms existing in the Glen Rose. The general structure, size, and shape of specimens in both formations are alike, the only difference being in the type of material comprising the test.

COELENTERATA

ANTHOZOA

MADREPORARIA IMPERFORATA

ORBICELLIDAE

Genus ORBICELLA Dana 1846

Orbicella travisensis Wells [16]

---

[16] Wells, J. W., Corals of the Trinity Division of the Comanchean of Central Texas, Manuscript form as of April 6, 1931.

Pl. I, Fig. 2-3.

"The corallum is a small, massive, convex or subglobose colony. All of the specimens found have been rolled or worn before fossilization and do not show the features of the outer surface. The corallites are cylindrical, averaging 2.0 mm. in diameter within the walls, separated by intercorallite areas 1.0-0.2 mm. in width. They are bounded by a thick wall ribbed by costae corresponding to the septa. The calices, as revealed in a small area on the surface of the type specimen, are circular, shallow, and but slightly projecting, with a diameter within the walls of 1.5 mm. The septa are 24 in number, arranged in three cycles and six regular systems, straight, unequal, slightly denticulate on their upper edges and strongly granulated laterally. The septa of the first and second cycles are strong and equal, extending to the columella, to which they are joined. The septa of the third cycle are thin and rarely extend more than a third of the distance to the columella. In longitudinal sections the inner edges are notched, and the septa of the last cycle appear to be slightly perforate. The costae, as seen in cross section, are equal, short and stout, rarely uniting between the corallites, but where they appear on the surface they extend over most of the intercorallite space. The columella is tabecular and well developed, united to the ends of the septa by processes. When viewed in cross section it appears to be formed of several vertical pillars, but in longitudinal section these pillars are seen to consist of interlacing rods. The endothecal dissepiments are delicate, thin, sparce, and horizontally disposed. The exothecal dissepiments are much thicker, more abundant, nearly horizontal, inclined downward from the corallite walls, numbering about 6 in a space of 5 mm. Where they unite midway between the corallites there is a vertical series of thin dissepiments. No synapticulae. No epitheca has been observed.

This species, when first seen in cross section, might be mistaken for some species of Columnastrea, but the lack of pali and the structure of the columella indicate a close relationship to Orbicella.

Compared with O. annularis (Ellis and Solander)[17], type species of the genus, the present species possesses smaller calices with the same number of septa which are more heavily granulated, and fewer endothecal dissepiments.

Occurrence: In the Travis Peak formation at the following localities: on Cow Creek about one mile below Travis Peak P. O., Travis Co.; about five miles west of Cox's Crossing, on the Austin-Marble Falls road, Burnet Co.; on the Austin-Marble Falls road in an arroyo to right of road near Spicewood, Travis Co."

This species is common near the top of the Cow Creek beds.

MADREPORARIA PERFORATA

AGARICIIDAE

Genus SIDERASTREA de Blainville 1830

Siderastrea cuyleri Wells [18]

Pl. I, Figs. 4-5

"The corallum forms a massive, probably convex colony. The corallites are distinctly subhexagonal in outline and are directly united by the walls which are thin and irregular. The calices are of medium depth, with an average diameter of 3.5 mm. within the walls for the mature corallites. The septa number from 24 to 36, and are imperforate, straight or slightly

---

[17] Vaughan, T. W., Bull. 103, U. S. Nat. Mus., pp. 364-375, pl. 80, 81, 82, 83, 84. 1919.

[18] Wells, J. W.: Corals of the Trinity Division of the Comanchean of Central Texas. Manuscript form as of April 6, 1931.

curved, nearly equal in thickness, and finely granulated or spinulose on their sides. Their upper edges cannot be seen in any of the specimens now at hand, but from the structure of the trabeculae as seen in longitudinal sections they are presumed to be beaded, with prominent inner teeth. The septa of the third and fourth cycles, when they are developed, are fused to the septa of the preceding cycle. From 8 to 12 of the principal septa are united to the columella. The synapticulae are well-developed in two rows near the wall and tend to fill up the interseptal loculi. The columella is composed of 3 or 4 fused papillae. The exterior of the corallum is not shown by any of the specimens.

This appears to be the first species of this well-known Tertiary and recent genus to be found in the Cretaceous. It compares with the recent S. radians and with several of the species listed by Vaughan [19] from the Tertiary formations of the West Indies. The characters of the genus are so well displayed by this Travis Peak form that the correctness of the identification cannot be very uncertain.

Occurrence: In the Travis Peak formation on Cow Creek about one mile below Travis Peak Post Office, Travis County, and about five miles west of Cox's Crossing on the Austin-Marble Falls road, Burnet County."

This species is common near the top of the Cow Creek beds.

MOLLUSCA

PELECYPODA

PRIONODESMACEA

NUCULACEA

---

[19] Vaughan, T. W., 1919. Fossil Corals from Central America. U. S. Natural Museum Bulletin 103, pp. 435-453.

NUCULIDAE

Genus NUCULA Lamarck 1799

Nucula (?) tharpi sp. nov.

Pl. II, Figs. 1-3.

Cast small, slightly inflated immediately below beaks, equivalve; beaks sub-central, situated almost terminally on posterior portion of dorsal margin, extending only slightly above hinge line; dentition unknown; dorsal margin wide, flattened, anterior portion long, straight, sloping gently to ventral margin; posterior portion short, straight, sloping abruptly to ventral margin; ventral margin broadly arcuate, sharp, thin, presenting a cuneate appearance dorsoventrally.

Measurements: Type, length 15, height 11, width 6 mm., or length, height, and width in the ratio 2.5 : 1.8 : 1. Whether this species is definitely a Nucula is questionable. Its general size and appearance resembles this genus more closely than any other.

Occurrence: Rare in Cow Creek beds. The type was found in this horizon 5 miles west of Cox's Crossing, Burnet County.

PARALLELODONTIDAE

Genus CUCULLAEA Lamarck 1801

Cucullaea gracilis Cragin

Pl. II, Figs. 4-6.

1893. Cucullaea gracilis Cragin, Geol. Surv. of Texas. 4th Annual Report, pp. 173, no pl.

1928. Cucullaea gracilis Adkins, Handbook of Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 88.

The following is Cragin's original description of this species:

> "Casts small, elongate, strongly compressed, the length about one and a half times the height, and about twice the breadth, breadth equalling from three-fourths to four-fifths of the height; beaks compressed and much slenderer than those of C. terminalis Con., placed quite near the anterior extremity; anterior and basal borders of cast forming a very thin and sharp, blade-like keel. Known from casts only; these symmetrical and evidently retaining the original form.
>
> Measurements: Of largest example, height 40, length 61, breadth 32; of another, height 31, length 45, breadth 24 mm.
>
> The casts of this small species differ from those of the C. terminalis in their compressed and elongate form. The level of greatest breadth is constantly higher than in casts of C. terminalis. The basal keel in casts of the latter species, though acute, is quite stout. Accidentally compressed casts of C. terminalis do not show, with their relatively increased height, the proportionally great length of C. gracilis."

Occurrence: This species occurs rather abundantly in the Cow Creek beds wherever they outcrop. The specimens collected fit Cragin's description well, although

Cragin did not mention this species as occurring in the Travis Peak.

Cucullaea hamletti sp. nov.

Pl. II, Fig. 7.

Cast small, sub-triangular, ventricose; beaks anteriorly situated, inflated, incurved, pointed, gaping; typical Cucullaea dentition; anterior and dorsal margins straight; posterior margin abruptly rounded, ventral margin broadly arcuate; umbonal slope steep dorso-ventrally; dorsal margin truncated posteriorly; muscle scars indistinct.

Measurements: Type, (fragmentary), length 38, height 32, and thickness of one valve 17 mm., or length, height, and thickness in ratio 1.2 : 1 : 1.1 .

G. hamletti is rather common and easily distinguished from other species because of its size and triangular shape.

Occurrence: This species occurs frequently in the Cow Creek beds throughout their distribution in Central Texas. The type was collected on Mr. Milam's Place, Cox's Crossing, Travis County.

Cucullaea sellardsi sp. nov.

Pl. II, Figs. 8-10.

Cast small, inflated; beaks almost central, gaping, decidedly curved inward, only slightly anterior, extending distinctly above hinge line; space between beaks wider than beaks themselves; dentition absent; dorsal portion of cast greatly enlarged in proportion to rest of form, ventral portion very thin; form appearing cuneate from end; cast slightly truncate posteriorly; pallial line clear in anterior portion, indistinct in posterior portion; ventral margin, thin, appearing carinate.

Measurements: Type, length 19, height 13, width 11 mm., or length, height, and width in ratio 1.7 : 1.2 : 1.

Occurrence: Cow Creek beds. The type was collected from this stratigraphic position at Dead Man's Hole, Hays County.

Cucullaea terminalis Conrad

Pl. III, Figs. 1-3.

1857. Cucullaea terminalis Conrad, Rep. U. S. and Mex. Bound. Surv., Vol. 1, pt. 2, p. 148, pl. 4, figs. 2, 2a.

1893. Cucullaea terminalis Cragin, Texas. Geol. Surv. 4th Ann. Rept., p. 174, no pl.

1893. Cucullaea terminalis Hill, The Invertebrate Paleontology of the Trinity Division, Biol. Soc. of Wash. Vol. VIII, p. 26, no pl.

1928. Cucullaea (Idonearca) terminalis Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 88.

Cast medium, broadly triangular, elongated posteriorly, inflated anteriorly, greatest thickness of cast just below beaks, anterior margin curved, posterior margin arcuate to straight; beaks large, incurved, situated posterior to anterior margin about one-fourth length of cast; anterior umbonal slopes distinct, convex; posterior umbonal slope rounded; muscle scars distinct; ornamentations unknown.

Measurements: Dimensions variable; specimens from Travis Peak measure length 53, height 43, and thickness 48 mm., or length, height, and thickness in ratio 1.2 : 1 : 1.1.

Because of the general triangular shape, C. terminalis is undoubtedly different from any of the other forms in the Trinity Division.

Occurrence: C. terminalis is more common in the

Glen Rose than in the Travis Peak. The general appearance of the Travis Peak and Glen Rose form is about the same. In the Travis Peak specimens of this species were collected from the Cow Creek beds at Hammett's Crossing, Travis County.

PTERIACEA

PTERIIDAE

Genus AVICULA Brug. 1753

Avicula eifleri sp. nov.

Pl. III, Fig. 4.

Cast, elongate, oblique; beaks pointed, umbonal ridge distinct, high, extending from beak to posterior portion of shell, bifurcated by a furrow on dorsal edge of ridge; above the groove extends a mantle beyond which is another groove similar to the one higher on the umbonal ridge; between the two grooves is a secondary ridge similar to the major one; beyond second groove is another mantle or flare which is relatively straight or flat; dentition poorly preserved; surface sculpturing consists of numerous rather heavy lines of growth.

Measurements: Type, length 100, height 70, thickness 14 mm., or height, length, and thickness in ratio 7.1 : 5 : 1.

This species occurs with A. whitneyi but is easily distinguished from it because of its flatness, the presence of two furrows, the pointed beak, and the heavy concentric lines of growth which are not present in A. whitneyi. A number of European species resemble this species but the specific differences are immediately discernable.

Occurrence: The type was collected from the Cow Creek beds on Mr. Milam's Place, Cox's Crossing, Travis County. A number of specimens of this species are found elsewhere at this same stratigraphic level.

Avicula whitneyi sp. nov.

Pl. IV, Fig. 1.

Cast elongate, ventricose, oblique; beaks pointed, inflated; umbonal ridge distinct, high, wide, extending from beak to posterior margin, broadly sigmoid; umbonal slope of ridge gradual on ventral side, distinct furrow on dorsal side; edge of cast flared beyond longitudinal furrow to hinge line; dentition con-

sisting of pseudocardinal and lateral teeth, lateral teeth being well-preserved; sculpturing consisting of numerous fine lines of growth.

Measurements: Type, length 110, maximum thickness 38 mm. Many specimens of the species are smaller than this.

This species is easily distinguished from its nearest relative in the Travis Peak, A. eifleri, in being more massive, thicker, in having only one important umbonal ridge, and in having a more inflated beak.

Occurrence: A. whitneyi is frequently present in the Cow Creek beds of the Travis Peak. The type was collected by Professor F. L. Whitney on Mr. Milam's Place, Cox's Crossing, Travis County. A number of other specimens were collected in this locality.

OSTRACEA

OSTREIDAE

Genus EXOGYRA Say 1819

Exogyra bullardi sp. nov.

Pl. IV, Fig. 2; V, Figs. 1-2;
VI, Figs. 1-2; VII, Fig. 1.

Shell, large, massive, thick, inequivalve, inequilateral, almost sub-quadrate; left or superior valve broadly convex, ornamented by a rather high ridge extending from beak down middle of shell to posterior portion producing an angular effect, angularity of ridge variable; right or inferior valve smaller, discoidal, operculiform; beak not prominent, low coiling spirally within margin; no costae present; irregular, rugged lines of growth form only other ornamentation.

Measurements: Type, length 90, height 120, and thickness 45 mm., or length, width, and thickness in the ratio of approximately 3 : 2 : 1.

There is no species so similar to E. bullardi as to be easily mistaken for it. Its large size distinguishes it from any other Exogyra in the Travis Peak and its stratigraphic position makes for distinction between this species and any other species higher in the Cretaceous. The shells are particularly noticeable because of their large size and the thickness of the valves.

Occurrence: This species occurs abundantly in the clays about 25 - 30 feet from the top of the Travis

Peak in Comal County. The type came from the vicinity of Rebecca Creek in Comal County, where the species is very abundant.

Exogyra hilli Cragin [20]

Pl. VII, Figs. 2, 3.

1889. Ostrea franklini Hill, Arkansas Geological Survey, p. 131, 132., pl. 5.

1893. Exogyra hilli Cragin, Texas Geological Survey, 4th Annual Report, p. 186, no pl.

1928. Exogyra hilli Adkins, Handbook of Texas Cretaceous Fossils, p. 113.

> "Small inequivalve, plicate, arcuate, rather narrow, the backward sweeping distal part particularly so; lower valve deep, exteriorly obtusely carinate, the anterior slope presenting a few, commonly 5-8, obtuse, radial folds; upper valve flat, its exterior often concave on the posterior part, and the anterior borden imbricate-thickened.
>
> Measurements: Height 28, length 17, convexity 11 mm." [20]

Occurrence: This little Exogyra is found occasionally in the Cow Creek beds. The specimen figured was

---

[20] Cragin, F. W. , A Contribution to the Invertebrate Paleontology of the Texas Cretaceous. Geol. Survey of Texas, 4th Ann. Rept. p. 186, 1893.

collected on Turnback Creek, western Travis County.

Exogyra weatherfordensis Cragin [21]

Pl. VII, Figs. 4-7.

1893. Exogyra weatherfordensis Cragin, Texas. Geological Survey, 4th Annual Report, p. 188, pl. XLV, fig. 7-10.

1919. Exogyra weatherfordensis Adkins and Winton, Univ. of Texas Bull. No. 1945, p. 65, pl. XIII, figs. 11-14.

1928. Exogyra weatherfordensis Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 114.

"Shell, small, very thin, its marginal outline sub-semicircular, postero-basally narrowed, and in occasional specimens produced into a prominent lobe as in d'Orbigny's fig. 6 of E. Boussingaultii (Pal. Fr., Cret., P. 468); lower valve carinated, often inflated and constricted on various parts, commonly ornamented on the posterior slope with narrow and delicate, subradiate or centrifugally curved plications, and on the anterior slope toward the anterior border, the latter border being feebly milled with; upper valve flat, marked with concentric imbricated lines; its anterior margin more or less thickened, milled, and bearing teeth corresponding to the ribs of the lower valve.

Measurements: Height 47, length 31, breadth 13 mm., in an average specimen. One caudate specimen has a height of 53 mm."

---

[21] Ibid. p. 188.

Specimens of E. weatherfordensis have been found in the Travis Peak which correspond closely to the description of the species as given by Cragin.

Occurrence: E. weatherfordensis occurs rather frequently in the clays below the shell breccia beds. The figured specimens came from this horizon on Mr. Milam's Place, Cox's Crossing, Travis County.

Genus OSTREA Linn. 1758

Ostrea camelina Cragin [22]

Pl. VIII, Figs. 1-3.

1869. Ostrea franklini Coquand. Monog. Genre Ostrea Terrain Cretace. p. 53, pl. 23, figs. 8-10

1884. Ostrea franklini White. Fourth Annual Report, U. S. Geol. Survey, p. 296, pl. 39, figs. 1-3.

1888. Ostrea franklini Hill. Annual Report Geol. Survey Ark. vol. 2, pp. 131-133, pl. 5, figs. 1-18a; pl. 6, figs. 19-25; pl. 7, figs. 28-30.

1893. Ostrea camelina Cragin. Texas Geol. Survey, Fourth Annual Report, p. 199, no pl.

1928. Ostrea camelina Adkins. Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 100, no pl.

"Shell of medium size, or rather large-medium, inequivalve, elevated-subtriangular, or pyramidal-ovate, tending to considerable length at the beginning of the basal third of the outline; lower valve deeply concave within, its

---

[22] Ibid. p. 199.

> exterior commonly p resenting a large-rounded, or sub-angular "hump" on the proximal half, with sometimes one or two more distal, similar, minor elevations, and often presenting a postero-ventral lobe marked off from the rest of the valve, by a radial sulcus, somewhat as in Gryphaea pitcheri but confined to the distal region, the ventral margin descending in semicircular outline below the lobe, the anterior margin tending to describe a rounded prominent outline opposite the posterior lobe; upper valve flat; beaks narrow and pointed, that of the lower valve pyramidal, often produced, sometimes straight, sometimes laterally notched or posteriorly reflected, or otherwise asymmetrical; abductor scar remote from the beaks.
>
> Measurements: (Taken from an average-sized lobate specimen.) Height 91, length 65, (the middle lobe making 18 of this), breadth 35 mm. In some specimens, the more rapid extension of the anterior margin gives a relatively much greater length than that of the specimen from which these measurements are given."

Occurrence: This is one of the most abundant species of Ostrea which occurs in the Travis Peak. The zone of O. camelina is located in the Cow Creek beds and particularly in the lower portion of these beds. Specimens are usually found as masses, forming beds of Ostrea agglomerate. Ordinarily this is the

species to which references are made when sections of the Cow Creek beds are given. The sizes of specimens vary greatly although a great many of them are of about the same size as given by Cragin in his original description. Variations from the sizes given by Cragin seem to trend toward smaller specimens.

Ostrea franklini Coquand [23]

Pl. IX, Figs. 1-6.

1860. Ostrea cretacea Owen, Arkansas, pl. 8, fig. et 7 (non Morton 1834).

1869. Ostrea franklini Coquand, Monog. Genre Ostrea Terrain Cretace, p. 53, p. 23, figs. 8-10.

1884. Ostrea franklini White, Fourth Annual Report U. S. Geol. Surv. p. 296, pl. 39, figs. 1-3.

1888. Ostrea franklini Hill, Annual Report Geol. Survey Ark., vol. 2, pp. 131-33, pl. 5, figs. 1-182; pl. 6, figs. 19-25; pl. 7, figs. 28-30.

1893. Ostrea franklini Cragin, Texas Geol. Survey, Fourth Annual Report 1893, p. 203, no pl.

1893. Ostrea franklini Hill. Wash. Biol. Soc. Proc., vol. 8, p. 23.

1900. Ostrea franklini Herrick and Johnson, Denison Univ. Sci. Lab. Bull. vol. 11, art. 9, p. 203, pl. Fig. 8.

---

[23] Coquand, H., Monographie du Genre Ostrea. 1869. p. 53.

1928. Ostrea franklini Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 101.

Following is a translation of Coquand's original description of this species:

> "Shell, oyster-like, ovate, pointed, elongated, slightly oblique, inequivalve; Inferior valve convex, rounded at the base, very pointed at top, ornamented with closely appressed concentric striations; superior valve shorter than the other, plate-like, ornamented with concentric lines.
>
> This species, as such, presents some resemblances to O. cretacea, but is separated from this form by being much more pointed and by having its striations not in layers and, above all, by the absence of elongated sides."

Measurements: O. franklini is one of the most variable species occurring in the Travis Peak. There appears to be a gradation from the narrow elongate forms to the less elongate and more rounded type, until finally the elongate types become entirely different, assuming a shape similar to a Gryphaea although retaining other characteristics of the Ostrea. The more elongated and relatively narrow variety is considered as O. camelina Cragin. Specimens of the latter species are usually about 100 mm. in length; O. franklini specimens are or-

dinarily much shorter, even in the elongate or narrow forms.

Occurrence: O. franklini occurs commonly in the Cow Creek beds of the Travis Peak, but is not limited to that zone. It is also found in the lower clays and distributed generally in the formation. The geographical occurrence of the species is not limited.

Ostrea whitneyi sp. nov.

Pl. X, Figs. 1-2; XI, 1-2; XII, 1.

Shell large, thick, massive, elongate, narrow; superior valve concavo-convex, with a well defined ridge extending from the beak to the ventral portion, traversing center of one shell; interior of the superior valve with long rectangular shaped ligamental area and muscle scar situated near center of shell; inferior valve flat, lid-like, elongated, narrow, with ligamental area corresponding to area in superior valve, outside of flat valve simple; anterior and posterior margins straight, posterior margin broadly curved; beaks varying in size and shape, sometimes distinctly curved as in Exogyra, other times straight, broad; ligamental area in forms with twisted beaks more restricted than

in straight forms; surface ornamentation consisting of distinctly high ridge on superior valve, along with minor small folds which extend off sides of main ridge, and many lines of growth which are abundant on each valve, giving the shell a corrugated effect.

Measurements: Size variable, type; length 85, height 160, and thickness 50 mm., or length, height, and thickness in ratio 1.7 : 3.2 : 1.

O. whitneyi is distinctive because of its large size. It occurs in about the same stratigraphic position as the large Exogyra bullardi but is easily distinguished from it by its height, thickness, and straight beak.

Occurrence: The only specimens of this species to be found were collected on the Austin-Marble Falls highway, 4.2 miles west of Cox's Crossing, Burnet County. The zone in which they occur is located stratigraphically about 17 feet below the top of the Travis Peak. Orbitolina texana Roemer was found in this same zone in abundance, and in some cases even cemented to specimens of Ostrea.

Ostrea alternans Cragin [24]

Pl. XII, Figs. 2-3.

1893. *Ostrea alternans* Cragin, A Contribution to the Invertebrate Paleontology of the Texas Cretaceous. Geol. Survey of Texas, Fourth Annual Report, p. 198.

1938. *Alectryonia alternans* Adkins. Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2938, p. 103.

"Commonly agglomerate, between a half and a third of the dimensions of *O. subovata*, Shum., and relatively shorter than that species in the direction of its height, ovate to rhomboidal, inequivalve, 8-12 radiate-plicate, the folds bold and acute, posterior border usually having an ear, or wing-like angle, a little below the beaks and which is often separated from them by an emargination, a small wing or lobe being also sometimes developed on about the middle of the posterior border; adductor scar situated beyond the middle of the valve; upper valve nearly flat, rather thin, rugose-wrinkled, distinctly radiate-plicate near the margin only, anterior and posterior edges not milled; lower valve thicker, deeply excavated, plicate over the entire valve, anterior and posterior borders without pronounced intro-marginal sulci; ligamental area triangular, less ample than in *O. subovata*, erect and pointed or posteriorly recurved according as the beaks vary from pyramidal to exogyrate.

Measurements: Height 61, length 47, breadth 26 mm."

---

[24] Cragin, F. W., *op. cit.*, p. 198.

Occurrence: O. alternans occurs rather frequently in the Cow Creek beds. Often they occur in this stratigraphic position in the form of Ostrea agglomerates. They have this mode of occurrence at Hamilton Pool, Dead Man's Hole, and many of the other outcrops of the Cow Creek beds.

Ostrea estherae sp. nov.

Pl. XIII, Figs. 1-2.

Shell medium, sub-rectangular, radiate plicate; beaks incurved, flattened; cartilage pit medium, straight or only slightly curved; superior valve much more flattened than inferior valve; surface of superior valve ornamented with 4 to 9 distinct plications or folds, which begin about midway between the beaks and the margins, and are heavy and angular; concentric lines of growth or irregular widths quite noticeable; from marginal regions decidedly truncated; inferior valve thick, massive, with incurved beak also showing definite lines of growth, margins of this valve correspond to those of the superior valve in being irregular.

Measurements: Type: length 54, height 75, and thickness 20 mm., or length, height, and thickness in

the ratio of 2.7 : 3.8 : 1.

This species has characteristics which resemble those of O. crenulimargo Roemer, but is distinguished from this species by being much larger. This one is also much larger than O. crenulimargo var. stonewallensis Cragin which is commonly considered as a larger variety than the species. Several European species bear close resemblances, but upon examination, many differences are immediately noticed. Although this form is variable in regard to the number of radial plications, its general appearance always remains essentially the same.

Occurrence: O. estherae is one of the most abundant forms in the Cow Creek beds. Forms of this species frequently occur as agglomerates and frequently compose beds near the base of the Cow Creek member. The type specimen was collected at Dead Man's Hole, Hays County.

TRIGONIACEA

TRIGONIIDAE

Genus TRIGONIA Brugiere 1789

Trigonia concentrica Cragin

Pl. XIII, Figs. 3-5.

1893. Trigonia concentrica Cragin. Texas Geol. Survey. Fourth Annual Report, p. 213, pl. XLI, fig. 4.

1928. Trigonia concentrica Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas. Bull. 2838. p. 120.

Cast small, triangular-ovate, posteriorly pointed, basal border compressed to a thin margin; posterior umbonal slope with two faint radial ridges which fade out midway between the anterior and posterior extremities; anterior hinge teeth having about eleven striae; very fine and distinct concentric ribs ornament the anterior portion of the shell, and posterior to the beaks, these give place to a few distinct tubercles; the posterior part of the shell is ornamented with unequal, prominent lines of growth; a vertical cleft separates the beak from the anterior adductor region.

Measurements: Length 50, height 36, thickness 24 mm.

Occurrence: This species is abundant in the Cow Creek beds. Cragin's species was collected from this horizon in Cow Creek in Travis County.

Trigonia hilli sp. nov.

Pl. XIII, Figs. 6-7.

Cast large inflated, about twice as long as high; beaks almost terminal, broad, rounded but not high, protruding only slightly above hinge line; clefts almost vertical, anterior to beaks; umbonal slope very gradual; top of specimen wide and flat, sloping from wide ventral dorsal area to thin edge on ventral margin; when observed from side the type presents saddle-like appearance due to elevation of extreme anterior and posterior portions; anterior portion much wider than posterior, presenting a cuneate appearance from top to bottom and from front to back; casts of posterior muscle scars appearing as raised protuberances situated laterally on dorsal side slightly posterior to middle of specimen; pallial line simple, distinct, teeth well preserved.

Measurements: The extreme posterior portion of the type is missing; the following measurements are approximated: length 80, height 45, and width 45 mm., or length, height and width in ratio 1.8 : 1 : 1.

Occurrence: Rare in Cow Creek beds. The type was found on Cow Creek one mile below Hensell's place.

Trigonia whitneyi sp. nov.

Pl. XIV, Figs. 1-2; XV, Figs. 1-5.

Cast usually large, sub-triangular, equivalve, inequilateral; dorsal and anterior portions wide and inflated, ventral and posterior portions compressed and pointed; beaks terminal, inflated, pointed, projecting noticeably above hinge line, giving dorsal margin an arcuate appearance; cleft between beak and anterior adductor region almost vertical; hinge teeth usually not present; umbonal slope gradual from wide anterior portion to pointed posterior edge; ornamented by 15 - 25 large, prominent ribs slightly curved in anterior and middle portions and appearing straight in posterior portion; tops of ribs further ornamented by numerous, irregularly spaced nodes; spaces between ribs slightly wider than ribs themselves and are characteristically square rather than angular at base.

Measurements: The type specimen is slightly smaller than those usually found. The dimensions of the type are: length 40, height 27, width 30 mm., or length, height,

and width in ratio 1.5 : 1 : 1.1.

This species is easily distinguishable from others in the Travis Peak in that the beaks project higher above the hinge line and the specimens are more inflated.

Occurrence: This species of Trigonia occurs abundantly in the Travis Peak. It has been found at all of the localities where the Cow Creek beds are exposed. The type was found on the bluff on the west side of Hamilton Pool, Travis County.

PECTINACEA

PECTINIDAE

Genus NEITHEA Drouet 1824.

Neithea sp.

Pl. XV, Fig. 6.

Cast fragmentary, medium, elongate, flattened, having numerous angular ribs; grooves between ribs and sides of ribs appear to have fine ribs; detail poor.

Measurements: Because of the fragmentary condition of the cast, the dimensions are not obtainable.

Occurrence: Cow Creek beds, 5 miles west of Cox's Crossing. This species is interesting because of its stratigraphic position and because of its size. Only one specimen has been collected from this zone.

ANOMALODESMACEA

ANATINACEA

PHOLADOMYACIDAE

Genus PHOLADOMYA G. B. Sowerby 1823.

Pholadomya aff. gigantea (Sowerby)

Pl. XVI, Figs. 1-3.

1836. Pholas giganteus J. de C. Sowerby, Trans. Geol. Soc., ser. 2, vol. iv, pp. 130, 338, pl. xvi, fig. 1.

1840. Pholadomya elongata A. Goldfuss. Petred. Germ., vol. ii, p. 270, pl. clvii, fig. 3.

1842. Pholadomya elongata Agassiz. Etudes crit. Moll. Foss., Myes. p. 57, pl. i, figs. 16, 17.

1842. Pholadomya scheuchzeri Agassiz. Ibid., p. 58, pl. ii, figs. 3-7, pl.iii, fig. 7.

1842. Pholadomya favrina Agassiz. Ibid., p. 59, pl. ii, figs. 1, 2.

1842. Pholadomya langii Voltz en Leymerie, Mem. Soc. Geol. de France, ser. 2, vol. v, p. 24.

1845. Pholadomya elongata d'Orbigny. Pal. Franc. Terr. Cret., vol. iii, p. 350, pl. cccLxii.

1845. Pholodomya gigantea E. Forbes. Quart. Jour. Geol. Soc., vol. i, p. 238.

1850. Pholadomya elongata d'Orbigny. Prodr. de. Pal., vol. ii, p. 73.

1852. Pholadomya favrina F. J. Pictet and W. Roux. Moll. Foss. Gres verts de Geneve, pp. 403, 546, pl. xxix, fig. 1.

1854. Pholadomya gigantea J. Morris. Cat. Brit. Foss. ed. 2, p. 220.

1855. Pholadomya elongata G. Cotteau, Moll. Foss. de l'Yonne, p. 55.

1855. Pholadomya elongata Pictet and E. Renvier. Foss. Terr. Aptien (Mater. Pal. Suisse, ser. 1), p. 61.

1858. Pholadomya elongata J. Vilanova-y-Piera. Me. Geog.-agric. de Castellon, pl. iii, fig. 16.

1861. Pholadomya elongata P. de Loriol. Anim. Invert. Foss. Mt. Saleve, p. 56.

1864-65. Pholadomya elongata Pictet and G. Campiche. Foss. Terr. Cret. Ste. Croix (Mater. Pal. Suisse, ser. 4.), p. 74, pl. civ, figs. 1-4.

1870. Pholadomya gigantea et elongata F. Stoliczka. Paleont. Indica, Cret. Fauna S. India, vol. iii, p. 74.

1875. Pholadomya gigantea C. Moesch. Mon. Pholadomyen p. 82, pl. xx, fig. 6; pl. xxxi, figs. 2-4.

1884. Pholadomya cf. gigantea, O. Weerth. Die Fauna des Neocom. im Teutoburg. Walde (Paleont. Abhandl., vol. ii), p. 34, pl. viii, figs. 2, 3.

1895. Pholadomya weerthii F. Vogel. Hollandisch. Kreide, p. 59.

1895. Pholadomya elongata G. Maas. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 279, pl. ix, figs. 1, 2.

1896. Pholadomya elongata A. Wollemann. Ibid., vol. xlviii, p. 850.

1900. Pholadomya elongata A. Wollemann. Die Biv. u. Gastrop. d. deutsch. u. holland. Neocoms. (Abhandl. d. k. preussisch. geol. Land., n. f., pt. 31), p. 133.

1900. Pholadomya elongata. G. Muller. Deutsch-Ost-Afrika, vol. vii, p. 557, pl. xxi, fig. 1.

1903. Pholadomya elongata C. Burckhardt. Paleontographica, vol. 1, p. 76, pl. xv, figs. 1, 2.

1908. Pholadomya elongata A. Stojanoff. Ann. geol. et min. de la Russie, vol. x, p. 116.

1909. Pholadomya gigantea Woods. A Monograph of the Cretaceous Lamellibranchia of England., vol. ii, pt. vi, p. 246, pl. xl, fig. 14; pl. xli, fig. 1.

Cast equivalve, inequilateral; beaks broad, wide, and extending only slightly above the hinge line; occurring one-fourth distance from anterior margin; cast swollen below the beaks, near central portion; dorsal view broad, ventral view showing cast tapering to a rounded edge; anterior border inflated and rounded; posterior portion more pointed and compressed at extremity; beaks small, strongly curved and meeting each other above

hinge line; surface of cast ornamented by numerous ribs (the type has 50), which radiate from beak, those anterior to beak extending in that direction, some running directly from beak to the ventral margin and others extending obliquely from beak to posterior portion of cast until finally, ribs are almost parallel to hinge; ribs not high, but are angular and regularly spaced, space between them being approximately three times as wide as ribs themselves; lines of growth on cast produce a reticulated effect.

The specimens of P. aff. gigantea found in the Travis Peak are slightly smaller than those which are described. This, however, is the only noticeable difference between the European specimens and those found in Central Texas. The proportions of the dimensions are almost the same.

ANATINIDAE

Genus ANATINA Lamarck 1809.

Anatina brilli sp. nov.

Pl. XVI, Figs. 4-6.

Cast small, flat, elongate, equivalve, inequilateral, sub-rectangular; anterior and posterior ends rounded;

beaks small, only slightly elevated above hinge line; ventral margin smooth, straight, or only slightly curved; truncated posteriorly, causing beaks to appear high from rear, and leaving sunken area under beaks on each side of hinge line; evident sinus on each side of cast, beginning at posterior margin and forming line which marks beginning of truncated area; sculpturing indeterminate except for a few concentric lines of growth.

Measurements: The dimensions of the type are as follows: length 35, height 23, and thickness 9 mm., or length, height, and thickness in the ratio 3.9 : 2 : 1.

Anatina brilli is about the same size as Anatina (?) pliculifera Cragin, which was described from the Malone of West Texas, but differs from A. pliculifera in not having the heavy concentric lines of growth and, inasmuch as the posterior portion of the cast is different, in not being so depressed. A. brilli differs from A. obliquiplicata Cragin, another basal Cretaceous form, in being smaller and in having the beaks situated nearer the center of the cast. Confusion of any other species with A. brilli will probably not be made.

Occurrence: A. brilli is widespread in the Cow Creek beds of the Travis Peak.

POROMYACEA

POROMYACIDAE

Genus LIOPISTHA Meek, 1864.

Liopistha jurafacies (Cragin)

Pl. XVII, Figs. 1-3.

1893. Homomya jurafacies Cragin. A Contribution to the Invertebrate Paleontology of the Texas Cretaceous, Geol. Surv. of Texas, Fourth Annual Report, p. 191, pl. xxxix, figs. 1-2.

1928. Homomya jurafacies Adkins. Handbook of Texas Cretaceous Fossils, Univ. of Texas. Bull. 2838, p. 140.

Cast elongate, sub-rectangular, with broadly rounded margins, ventral one being very broadly arcuate, dorsal margin almost straight; beaks inflated, incurved, gaping, pointed, situated anteriorly, terminal, and extending noticeably above hinge line; slope of anterior margin from beaks ventrally about 65°; sulcus and ridge extending from anterior portion of beaks ventrally to anterior margin; posterior portion of beaks ventral to anterior margin; posterior to beaks cast becomes compressed having a thickness of about three-fourths maximum thickness, slope marking beginning of compressed area steep, at bottom of which is a sinus which extends from posterior portion of beaks to posterior of ventral

margin; cast again depressed below beaks, becoming flattened near ventral margin; surface of cast ornamented by numerous, irregularly spaced lines of growth.

Measurements: The specimen at hand has been crushed and as a result is slightly distorted, however, the dimensions are approximated: length 95, height 75, and thickness about 55 mm., or length, height, and thickness in ratio 1.7 : 1.5 : 1.

Occurrence: L. jurafacies occurs abundantly in the Cow Creek beds of the Travis Peak. They have been found at every place where collections were made by the writer.

TELEODESMACEA

CYPRICARDIACEA

PLEUROPHORIDAE

Genus ARCTICA Schumacher 1817

Arctica mcallisteri sp. nov.

Pl. XVII, Figs. 4-6.

Cast medium, ventricose, length exceeding height; anterior margin rounded, slightly flared; posterior margin about two-thirds height of anterior margin, sharply curved; ventral margin thin, broadly arcuate; inflation

in dorsal and anterior portion presenting cuneate appearance dorso-ventrally and anterio-posteriorly; umbonal slopes and margins steep; muscle scars high, pallial line entire, distinct; beaks inflated, incurved, pointed, distinctly anteriorly situated; ends of beaks almost flush with end of lower anterior margin; grooves alternating with small ribs extending from beaks to anterior margin.

Measurements: Type, length 70, height 54, thickness 47 mm., or length, height, and thickness in ratio 1.5 : 1.1 : 1.

A. mcallisteri is distinguishable from other species occurring in this region in having the anterior edge of the beaks almost flush with anterior margin, being only slightly posterior.

Occurrence: Cow Creek beds at Hammett's Crossing, Travis County.

Arctica medialis (Conrad)

Pl. XVIII, Figs. 1-3.

1857. Cardium mediale Conrad, Rep. U. S. and Mex. Bound. Surv., vol. 1, part 2, p. 19, pl. 4, figs. 4a, b.

1893. Cyprina mediale Cragin. Texas Geol. Surv. Fourth Annual Report p. 178, no pl.

1893. Isocardia (?) medialis Hill. Wash. Bio. Soc. Proc., vol. viii, p. 31, pl. 2, figs. 4, 5; pl. 3, fig. 6.

1928. Arctica medialis Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 152.

Cast small to medium, ovate, inflated; anterior margin rounded; posterior margin more truncate, pointed, situated decidedly anterior on anterior dorsal margin; anterior umbonal slope slightly curved; posterior umbonal slope almost straight, sometimes slightly truncate; muscle scars distinct, protuberant surface ornamentation absent, but probably consisted of simple lines of growth.

Measurements: There is a great diversity of forms of A. medialis. Those in the Travis Peak appear much smaller and less inflated than those in the Glen Rose. A form found in the Travis Peak has the following dimensions: length 47, height 44, and thickness 31 mm., of length, height, and thickness in ratio 1.5 : 1.4 : 1.

Occurrence: Cow Creek beds. The specimen figured was collected from the Cow Creek beds at Hamilton Pool, Travis County.

Arctica roemeri (Cragin) [25]

Pl. XVIII, Fig. 4.

---

[25] Cragin, F. W., Ibid. p. 179.

1893. Cyprina roemeri Cragin, Texas Geol. Surv., Fourth Annual Report, p. 180, pl. xxxviii, figs. 1, 2.

1928. Arctica roemeri Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2838, p. 152, no pl.

Following is Cragin's original description:

"Cast large, triangular-ovate, of quite moderate thickness, rather elongate, being somewhat produced at the posterior extremity and having its greatest diameter in a line drawn thence to the anterior extremity of either beak, the length considerably exceeding the height and the latter similarly the thickness; beaks large, elevated oblique, their summits curved inward and ranging boldly forward, their horizontal section much more extended parallel to than transverse to the hinge line, closely approximated in the cast (probably in contact in the shell itself), their apices much less remote from the anterior adductors than in A. texana Conrad, a subdued furrow radiating from the umbonal summit across the mid-anterior portion of the disc of the cast, rear of either umbo narrowly convex from right to left and forming a broad, sweeping curve of gradually diminishing convexity from summit to base; anterior adductor impression profound; pallial line entire, and in the anterior part accompanied by relief indicating the short radial folds seen commonly in large shells of this genus.

Measurements: Height of cast 88, length 103, breadth 63 mm. A larger cast, imperfect as to length, gives height 97, estimated length 115, breadth 70 mm. The form was collected in the Travis Peak."

Occurrence: A. roemeri occurs much more abundantly in the Glen Rose than in the Travis Peak. The writer has collected only Travis Peak forms from the Cow Creek beds.

ASTARTACEA

ASTARTIDAE

Genus ASTARTE J. Sowerby 1816

Astarte pikensis (Hill)

Pl. XVIII, Figs. 5-7.

1888. Corbicula (?) (Astarte) pikensis Hill. Annual Report Arkansas Geol. Surv., vol. ii, p. 134, pl. 2, Figs. 13, 13a, 14, 15, 16, 17.

1893. Eriphyla pikensis Hill. Biol. Soc. of Wash. Proc., vol. vii, p. 16, 38, pl. iv, figs. 4-6.

1928. Astarte (Eriphyla) pikensis Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas. Bull. 2838, p. 155.

Cast sub-triangular, only slightly inflated, outer ventral margin smooth; sculptured with heavy concentric ribs; beaks distant, prosogyrate, forming a distinct lunule; dentition poorly represented.

Measurements: Figured specimen, length 17, height 14, thickness 8 mm., or length, height, and thickness in ratio 2.12 : 1.7 : 1.

Although Hill did not describe this species from this area, it is logical to expect it in the Travis Peak inasmuch as the formation from which it was described in Arkansas is about the same age as, or only slightly younger than, the Travis Peak in Central Texas.

Occurrence: This species occurs consistently in the shell breccias in the Cow Creek beds.

CRASSATELLITIDAE

Genus REMONDIA Gabb. 1869

Remondia wellsi sp. nov.

Pl. XVIII, Figs. 8-9.

Cast small, sub-triangular, ventral margin arcuate; beaks centrally located on dorsal margin; lunule present immediately anterior to beaks; cast sculptured by several heavy concentric ribs.

Measurements: Type, length 6, height 6, width 4 mm., or length, height, and width in ratio 1.5 : 1.5 : 1.

This species differs from others described from strata of this age by being smaller and having larger ribs. The type is a cast of the outer surface of the shell.

Occurrence: Cow Creek beds. The type was collected from this zone at Hamilton Pool, Travis County.

CYRENACEA

CYRENIDAE

Genus CYRENA Lamarck 1818

Cyrena arkansasensis Hill

Pl. XIX, Figs. 1-3.

1888. Cyrena (Corbicula ?) arkansasensis Hill. Annual Report Geol. Surv. Arkansas for 1888, vol. 2, pp. 133, 134, pl. 2, fig. 20; pl. 4, figs. 3, 3a, b.

Valves free, rounded, sub-equilateral, inflated, smooth margins; sculptured only with concentric lines of growth; beaks prosogyrate and extending only slightly above hinge line, forming a lunule in the anterior portion; cast usually small, ordinarily under two centimeters in diameter.

Measurements: Figured specimen, length 28, height 23, and width 14 mm., or length, height and width in ratio 2 : 1.6 : 1.

This species is undoubtedly the same as the one described by Hill from the Trinity beds of Arkansas.

CARDITACEA

CARDITIDAE

Genus CARDITA Brugière 1789

Cardita browni sp. nov.

Pl. XIX, Figs. 4-6.

Cast medium, elongate, sub-quadrate, plump; beaks very prominent, almost terminal, prosogyrate, inflated, incurved; decided lunule present; dentate ventral margin broadly arcuate connecting small, rounded anterior and large rounded posterior regions; umbonal ridge extending from posterior portion of beaks to posterior portion of ventral margin; long and oblique cardinal teeth; cast sculptured with numerous ribs radiating from beaks.

Measurements: Type, length 45, height 35, and thickness of one valve 15 mm., or length, height and thickness in ratio 3 : 2.3 : 1.

Occurrence: No species of Cardita have been described which could easily be confused with this form. C. browni occurs in the Cow Creek beds of the Travis Peak. The type was found at Dead Man's Hole, Hays County.

LUCINACEA

UNICARDIIDAE

Genus PHACOIDES Blainville

Phacoides potosina (Castillo and Aguilera)

Pl. XIX, Fig. 7.

1895. Lucina potosina Castillo and Aguilera. Bol. Com. Geol. Mex., no. 1, p. 6, pl. 4, figs. 2, 3, 6; pl. 5, figs. 11-14.

1905. Lucina potosina Cragin, Paleontology of Malone Jurassic Formation of Texas, U. S. Geol. Surv. Bull. 266, p. 72, pl. xiii, figs. 4, 5.

1928. Phacoides (?) potosina Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas. Bull. 2838, p. 148.

Cast small, inequilateral, relatively thick, length exceeding height; beaks inconspicuous, almost centrally located and extending only slightly above hinge line; lunule present; dorsal margin almost straight, being only slightly concave in anterior region and flatly convex in posterior region; ventral margin only slightly arcuate, joining broadly curved anterior and posterior margins; cast ornamented with several irregularly spaced rather heavy, concentric ribs, increasing in size as they approach the beak.

Measurements: Figured specimen, length 20, height 19, width 8 mm., or length, height, and width in ratio 2.25 : 2.1 : 1.

The Travis Peak form of this species resembles very closely those figured heretofore as from the Jurassic. It is likely that better specimens of the species were

available, differences would be discernable; however, all specimens observed appear to be the same as those figured by Castillo and Aguilera and also by Cragin.

Occurrence: This species is found frequently in the Cow Creek beds throughout Central Texas.

CARDIACEA

CARDIIAE

Genus PROTOCARDIA Beyrich. 1845.

Protocardia goffi sp. nov.

Pl. XIX, Fig. 8.

Cast small, triangular, inflated below beak; beak almost ventrally located, protruding above hinge line; dorsal anterior and posterior margins with almost straight edges, ventral margin broadly arcuate; ornamentation consisting of numerous lines of growth; posterior one-fifth of cast sculptured by several radial ribs extending from beak directly to ventral margin, interspaces between ribs being about same width as ribs themselves.

Measurements: Length 40, height 35, width 24 mm., or length, height, and width in ratio 1.7 : 1.5 : 1.

This species is probably most nearly related to P. texana (Conrad) than to any other species, but is differentiated from it by being more elongate and more triangular.

Protocardia multistriata Shumard

Pl. XIX, Fig. 9.

1854. Cardium multistriatum Shumard. Geol. of Red River, p. 207, pl. 4, fig. 3.

1857. Cardium (Protocardium) multistriatum Conrad. Descriptions of Cretaceous and Tertiary Fossils in: W. H. Emory, Report of the U. S. and Mex. Bound. Surv., vol. 1, part 2, p. 149, pl. 6, figs. 4a-c.

1920. Protocardia sp. aff. multistriata Adkins. The Weno and Pawpaw Formations of the Texas Comanchean, Univ. of Texas. Bull. 1856, p. 126, pl. 10, figs. 21-26, 32.

1928. Protocardia multistriata Adkins. Handbook of Texas Cretaceous Fossils, Univ. of Texas. Bull. 2838, p. 160.

Cast sub-rotund, ventricose, length and height almost equal, beaks centrally located on dorsal margin extending prominently above hinge line; posterior dorsal margins slightly truncated, posterior portion of cast covered with about 15 fine, radiating ribs oc-

cupying about one-third of surface of cast; remainder of cast being marked with numerous fine, equally spaced concentric ribs.

Measurements: Length, height, and width in ratio 3 : 3 : 2.

It seems quite probable that this, like other species of Protocardia, may have a long range and extend down into the Trinity Division, instead of being confined to the Washita Group.

Occurrence: This species occurs in the Cow Creek beds at Hamilton Pool, Travis County. Specimens of this species are not frequently found, and those which have been found are so poorly preserved that it is difficult to definitely determine the exact characteristics of them. P. multistriata occurs rather commonly in the Washita group in North Texas.

Protocardia aff. sphaeroidea (Forbes)

Pl. XIX, Figs. 10-12.

1845. Cardium sphaeroidium E. Forbes. Quart. Jour. Geol. Soc., vol. 1, p. 343, pl. 2, fig. 8.

1850. Cardium sphaeroidium A. d'Orbigny. Prodr. de Pal., vol. 2, p. 79.

1853. Cardium neckerianum F. J. Pictet and W. Roux. Moll. Foss. Gres verts de Geneve, pp. 424, 425, pl. xxx, fig. 3.

1853. Cardium sphaeroideum Pictet and Roux. Ibid. p. 546.

1854. Cardium sphaeroideum J. Morris. Cat. Brit. Foss., ed. 2, p. 193.

1856. Cardium sphaeroideum F. J. Pictet and E. Renevier. Foss. Terr. Aptien (Mater. Pal. Suisse, ser. 1), p. 77, pl. ix, fig. 3.

1866. Cardium sphaeroideum F. J. Pictet and G. Campiche. Foss. Terr. Cret. Ste. Croix. (Mater. Pal. Suisse, ser. 4.), p. 260.

1871. Cardium sphaeroideum (?Laevicardium) F. Stoliczka. Paleon. Indica. Cret. Fauna S. India, vol. iii, p. 213.

1908. Protocardia sphaeroidea Woods. The Cretaceous Lamellibranchia, Paleon. Soc., vol. ii, part v, p. 195, pl. xxi, figs. 2, 3.

The following is Wood's [26] description of this species:

"Shell stout, large, much inflated, higher than long, slightly inequilateral. Anterior and ventral margins rounded. Posterior margins truncated, forming angles with the postero-dorsal and ventral margins. Umbones prominent, with a small forward curvature, and an inconspicuous carinae extending to the postero-ventral angle and limiting the flattened postero-dorsal area.

---

[26] Woods, H., The Cretaceous Lamellibranchia, p. 195.

Ornamentation consists of regular, broad, flat concentric ribs separated by narrow grooves. On the posterior area strong growth ridges are present.

Measurements:

	1	2	3	4	5	
Length	79	76	73	69	47	mm.
Height	84	91	87	87	48	mm.

Affinities: Pictet and Campiche state that this species is very near to C. imbricatarium (Deshayes), but that the posterior area is more flattened and forms an angle with the sides of the shell; also the truncated posterior margin is relatively longer.

Remarks: In this species, the radial ornamentation of the posterior area is either very indistinct or quite obselete. There is considerable variation in relative height and length of the shell."

Specimens from the Travis Peak resemble almost exactly those which were described and figured by Woods. The measurements coincide almost precisely. The general shape of the shell, the width of the ribs, the truncated sides, and other features seem identical with the species described as Cardium sphaeroideum by Forbes and later as Protocardia sphaeroidea by Woods.

Occurrence: Specimens similar to those in the Travis Peak have also been noted in the Glen Rose. The forms in the Travis Peak occur rather frequently in the

Cow Creek beds. The specimens figured in this paper were collected at Hamilton Pool, Travis County.

VENERACEA

VENERIDAE

Genus CYPRIMERIA Conrad 1864

Cyprimeria whitneyi sp. nov.

Pl. XX, Figs. 1-2.

Calcitized pseudomorph large, thick, massive, sub-circular, equivalve, inequilateral; beaks prosogyrous, small, inconspicuous; dentition absent in type, but casts show right valve having two cardinals with posterior one bifid, and left valve with three cardinals, each valve having a posterior lateral; specimen sculptured with numerous concentric lines, decidedly parallel to margin; margins smooth and well rounded externally.

Measurements: Type, length 90, height 85, width 35 mm., or length, height, and width in ratio 2.6 : 2.4 : 1.

Cyprimeria whitneyi resembles very closely the description of C. gigantea Cragin, but is distinguished

from it by being characteristically much smaller. C. gigantea also occurs stratigraphically much higher, having been reported from the Grayson formation of Denton County. The casts of C. whitneyi are found frequently and are different from any which have been described. They are much larger than C. texana (Roemer) and other species of Cyprimeria which are found so abundantly in the Lower Cretaceous of Texas.

Occurrence: This species occurs in the upper-most portion of the Cow Creek beds. The type and several other specimens were found five miles west of Cox's Crossing, Burnet County.

Genus MERETRIX Lamarck 1799

Meretrix stantoni sp. nov.

Pl. XX, Figs. 3-5.

Cast small, ventricose, equivalve, free; margins smooth; ventral margin broadly arcuate; beaks prosogyrous; lunule well developed; anterior adductor muscle scar situated slightly posterior to base of lunule; pedal muscle scar situated near margin below posterior dorsal portion; pallial line distinct; pallial sinus

present; dentition marked by three cardinals in each valve with additional lateral teeth along hinge line; ornamentation absent.

Measurements: Type, length 41, height 32, and thickness 19 mm. Specimens, in general, have length, height, and thickness in ratio 2.2 : 1. 7 : 1.

This species resembles Meretrix tippana Conrad, but is characteristically much larger. The general shape of M. stantoni is similar to M. cretacea Conrad, but is by far too large to correspond to that species. The size of M. stantoni is nearer that of M. leonensis ? Conrad which was reported in the Buda limestone by Whitney,[27] however, in M. stantoni, there is an abrupt drop in the cast directly in front of the beaks which is not found in M. leonensis ? Conrad.

Occurrence: This species occurs frequently in the Cow Creek beds of the Travis Peak. The type was

---

[27] Whitney, F. L., Fauna of the Buda Limestone, Bull. Univ. of Texas, p. 18, 1911.

collected from this horizon at Dead Man's Hole, Hays County. Specimens which probably belong to this species have also been found in the Glen Rose formation in central Texas.

Genus PTYCHOMYA Agassiz 1842

Ptychomya wellsi sp. nov.

Pl. XX, Figs. 6-8.

Form represented by casts of internal and external structure of same specimen; casts rounded, compressed, beaks almost centrally located, being only slightly anterior, elevated only slightly above hinge line; resilium external, three cardinal teeth in each valve; anterior, posterior and ventral margins broadly rounded; anterior dorsal margin slopes abruptly to anterior portion, posterior dorsal margin with a more gradual slope to posterior portion; cast of exterior indicates presence of a lunule; beaks small, compressed, and pointed; exterior of cast highly ornamented by radiating ribs which in anterior dorsal portion are divaricate,

often same rib assuming a vertical position to position of divarication where they assume a sub-horizontal position and then an upward trend; concentric lines of growth crossing radiating ribs produce a reticulate effect.

Measurements: The type specimen is incomplete, but the following dimensions are approximated: length 55, height 55, and thickness of right valve 10 mm., or length, height, and thickness in ratio 2.75 : 2.75 : 1.

Occurrence: The type of Ptychomya wellsi was found on Mr. Milam's place near Cox's Crossing, Travis County. Its range in the Travis Peak is limited to the Cow Creek beds and it is exceedingly rare even there.

Panopea solcheri sp. nov.

Pl. XXI, Figs. 1-3.

Cast elongate, ventricose, equivalve, inequilateral; anterior margin rounded, ventral margin broadly arcuate, posterior margin much more sharply

arcuate than anterior margin; beaks anteriorly located, protruding only slightly above hinge line; umbones inflated, decidedly incurved, pointed, not in contact; anterior dorsal margin with steep slope extending from beak to anterior margin; posterior-dorsal margin truncate with a gradual slope from beak to posterior margin; both anterior and posterior portions of cast gaping; edges of valves flared on ends; posterior portion more elongate and less rounded than anterior portion; ornamentation consisting of concentric lines of growth and occasional irregularly spaced folds.

Measurements: Type, length 68, height 41, and thickness 30 mm., or length, height, and thickness in ratio 2.3 : 1.4 : 1.

P. solcheri resembles very closely P. gurgitis (Brongniart). P. gurgitis is a European species which is found in about the same stratigraphic position as the Travis Peak. Eight or more names have been applied to this single species. This large number indicates that the geographic distribution of the species is rather wide. It is possible, al-

though improbable, that P. solcheri is a variety of P. gurgitis. Ordinarily P. solcheri is more elongated and the posterior portion more pointed than in this species. P. solcheri also resembles somewhat the specimens figured as Pleuromya inconstans Castillo and Aguilera, but differs from P. inconstans in having the beaks located nearer the anterior margin, in having the beaks thicker and more inflated, and in being more pointed posteriorly. P. solcheri is also quite different from Pleuromya ? henselli Hill in being decidedly smaller and in having the beaks situated more anterior.

Occurrence: P. solcheri occurs very abundantly in the Cow Creek beds of the Travis Peak. At Dead Man's Hole, Hays County, specimens of this species are particularly common. The figured specimens were collected at this locality.

Panopea pattoni sp. nov.

Pl. XXI, Figs. 4-6.

Cast elongate, equivalve, inequilateral, beaks decidedly anterior, extending noticeably above hinge

line; posterior portion of beaks nearly central, inflated, incurved, pointed, distant; anterior umbonal slope steep; posterior umbonal slope gradual; anterior margin rounded, posterior margin much smaller and more sharply arcuate, ventral margin nearly straight or very broadly arcuate; specimens show maximum thickness just below beaks; viewed dorsally, posterior portion of casta appears decidedly compressed, compression beginning at beaks and continuing to posterior margin until at this margin, thickness is only approximately one-third thickness below beaks; from side cast again appears to be much reduced in the posterior portion, reduction again beginning at the posterior part of beak; ornamentation consists of numerous lines of growth with occasional minor folds, these not being distinct in all specimens.

Measurements: The maximum measurements of the type cast are: length 57, height 32, and thickness 23 mm., or length, height, and thickness in ratio 2.5 : 1.4 : 1. The type is about average size.

Confusion of Panopea pattoni with any of the other species of this genus is very unlikely because of the characteristic posterior portion of the cast. P. pattoni is found associated with P. solcheri, but is quite distinguishable from it because of its general shape and size, P. pattoni being much smaller. This species resembles Pholadomya knowltoni Hill, but is readily distinguishable from it in being much smaller, more elongate, more truncate in the posterior portion, and in having beaks farther apart.

Occurrence: This species occurs commonly in the Cow Creek beds of the Travis Peak. The type came from this stratigraphic position at Dead Man's Hole, Hays County. Specimens of this species may be found in the Cow Creek beds wherever those beds outcrop.

GASTROPODA

STREPTONEURA

ASPIDOBRANCHIA

RHIPIDOGLOSSA

TURBINIDAE

Genus TURBO Linn. 1758

Turbo konzi sp. nov.

Pl. XXI, Figs. 7-11.

Cast medium, whorls few, globose, spire low, large apical angle; form three to four volutions present, whorls rounded, very convex between sutures, truncated posteriorly, increasing in size rapidly from protoconch to body whorl; last whorl exceedingly large in proportion to rest of cast; ornamentation absent, detailed character of aperture undeterminable.

Measurements: Type, length 26, thickness 43 mm.

It is possible that this genus might be Gyrodes instead of Turbo. The form in general resembles Turbo munitus Forbes, but is easily distinguished from it by being much thicker, having a lower spire and a larger body whorl.

Occurrence: This species occurs rather frequently in the upper shell breccia bed of the Travis Peak. A number of specimens were collected one mile west of Cox's Crossing, Travis County. The type was among those collected at this locality.

Turbo aff. munitus Forbes

Pl. XXII, Figs. 1-3.

1845. Turbo munitus Forbes. Lower Greensand fossils, Quart. Jour. Geol. Soc. of London, vol. 1, p. 348, pl. 4, fig. 3.

1847. Turbo forbesianus d'Orbigny, Prodrome de Paleontologie, p. 116, no pl.

1854. Turbo munitus (Forbes), Renvier, Pictet and Renvier, Pal. Suisse, p. 38, pl. 4.

1860. Turbo munitus Pictet and Campiche, Materiaux pour la Paleont., Suisse.

Cast medium to large, perforate, whorls few, globose, spire low, large apical angle; usually 3 to 4 volutions present; whorls rounded, very convex between sutures; sutures sunken very distinct; whorls near apex very small, increasing rapidly in size; fragments of shell shows that surface orna-

mentation consists of both horizontal and vertical markings on edge of whorl with two distinctly noticeable sets of tubercles consistent in position on volutions, one series being on posterior edge of whorl, and other near center of whorl; between these sets of tubercles are situated about three small ribs which are parallel to them; vertical markings consist of lines of growth which produce a cancellated effect as they cross other ridges; complete aperture indistinct.

Measurement: Figured specimen, length 59, thickness 51 mm. This species appears to be identical with the one described by Pictet and Campiche as Turbo munitus Forbes. The markings, the general size, and shape of the cast, with the exception of the apertural face, which varies slightly, appear to be identical.

Occurrence: The only specimen at hand was collected 5 miles west of Cox's Crossing, Travis County, from the Cow Creek beds.

CTENOBRANCHIATA

PLATYPODA

PTENOGLOSSA

NATICIDAE

Genus NATICA Scopoli

Natica travisensis sp. nov.

Pl. XXII, Figs. 4-6.

Cast very small, globose, perforate, smooth, spire short; apical angle about 73°, consisting of about 4 closely coiled whorls; volutions truncate posteriorly; broadly rounded anteriorly; body whorl large, extremity of which is flared; aperture ovate; surface ornamentations absent.

Measurements: Type, length 10, thickness 7 mm.

N. travisensis would probably not be confused with any other species in this region. The general shape resembles that of N. avellana Roemer, but is distinguished from that species in being smaller and having fewer volutions.

Occurrence: Cow Creek beds. The type was found in this horizon on Cow Creek, Travis County.

Genus TYLOSTOMA Sharp 1869

Tylostoma simondsi sp. nov.

Pl. XXII, Figs. 7-9.

Cast medium, globose, thick, smooth; apical angle large, spire low, with three volutions; whorls rounded, appearing slightly compressed when viewed from the apex; body whorl large, occupying three-fourths the length of cast; whorls slightly convex between sutures; sutures distinct, deep; posterior portion of whorls truncated; surface smooth, ornamentations absent, with the exception of varices which occur at 180° positions.

Measurements: Type, length 84, maximum thickness 78 mm.

Tylostoma simondsi would probably not be confused with any other species in the Travis Peak or Glen Rose. The general shape of this species resembles that of Lunatia (?) pedernalis Hill (not Roemer) but differs from it in having the varices which are characteristic of Tylostoma. T. simondsi also resembles Natica (?) pedernalis Roemer but differs from it in being smaller and in having a higher spire.

Occurrence: The type was collected from the Cow Creek beds one mile west of Cox's Crossing in the upper shell breccia beds.

Tylostoma bullardi sp. nov.

Pl. XXIII, Figs. 1-3.

Cast medium; apical angle about 61°; spire high consisting of about four or five volutions; last whorl forming more than half of the cast; whorls closely coiled, forming a gentle slope from anterior to posterior margin; sutures distinct; whorls smooth; areas between sutures almost straight or only slightly convex, not inflated; aperture not represented on type; groove marking position of a varix on side of cast; other surface ornamentation absent.

Measurements: Type, length 40, and thickness 27 mm.

T. bullardi is a much smaller species than any of the others of this genus in this stratigraphic position and therefore may be easily distinguished.

Occurrence: Cow Creek beds. The type was collected from this horizon on Cow Creek, Travis County.

TAENIGLOSSA

APORRHAIDAE

Genus APORRHAIS Aldrovande 1618

Aporrhais deeni sp. nov.

Pl. XXIII, Figs. 4-5.

Cast medium, turreted, forming an apical angle of about 28°, but somewhat variable in different specimens; whorls about 7 in number, convex between sutures, which are distinctly marked; whorls ornamented by closely situated vertical folds which increase in size as later chambers are added; number of folds on each whorl constant; folds extending vertically from suture to suture, and are more protuberant near upper suture than lower; last whorl expands into a wing (absent in type specimen); aperture elongate; vestige of posterior canal present in some casts.

Measurements: Type, length 42, thickness 19 mm. The size of the specimens of this species varies, although the proportions remain approximately the same.

This species resembles several others which have been described from the Aptian of Europe. It very closely resembles Aporrhais affinis Coquand, but is distinguished from it by being smaller and by not having the spiral ribs on the body whorl. A. spartacus Coquand and A. vilanoe Coquand have the same general appearance as A. deeni, but are shorter and have more truncated whorls. Perhaps the closest relative of A. deeni is A. priamus Coquand, although it may be distinguished from that species by having slightly larger whorls and in having more folds on each whorl. A. deeni is smaller than either A. simondsi or A. travisensis, and is larger than A. henryi.

Occurrence: The type was collected in the Cow Creek beds at Hamilton Pool, Travis County. The horizontal distribution of this species is general.

Aporrhais henryi sp. nov.

Pl. XXIII, Figs. 6-7.

Cast elongate; apical angle about 28°; consisting of about 5 or 6 volutions which are only

moderately convex between suture lines; suture lines deep and well marked; areas between sutures ornamented by elongate vertical folds which extend almost from suture to suture and which are larger on end of fold nearer apex, exposed ends of volutions truncate; last formed chamber large, and smooth with the exception of ornamentations which are confined to portion toward the apex; character of canal system indistinct.

Measurements: Type incomplete, length 32, thickness 13 mm.

This species is very similar to A. spartacus Coquand, but differs from it in being more elongate in proportion to the number of whorls, and in having a smaller apical angle. A. henryi differs from A. deeni in not being as thick, and from A. simondsi and A. travisensis in being much smaller.

Occurrence: This species has a wide distribution horizontally. It is found rather abundantly in the Cow Creek beds. The type specimen was collected one mile west of Cox's Crossing, Travis County.

Aporrhais simondsi sp. nov.

Pl. XXIII, Fig. 8.

Cast elongate, spire elevated, consisting of four or more volutions which gradually increase in size from protoconch to body whorl; whorls between deep sutures slightly elevated; apical angle small, body whorl with a wing-like projection on apertural face; surface ornamentation absent, cast often flattened.

Measurements: Incomplete type, length 45, thickness 24 mm.

A. simondsi somewhat resembles A. deeni, but is distinguished from that species in being larger. It differs from A. travisensis in being much smaller and in having a much smaller body whorl.

Occurrence: Cow Creek beds. The type was collected from this horizon on Mr. Milam's Place, Cox's Crossing, Travis County.

Aporrhais travisensis sp. nov.

Pl. XXIII, Fig. 9.

Cast medium to large, perforate; spire rather high, apical angle medium, four to six volutions,

the last of which occupies about as much space as all of others; sutures distinct, whorls between sutures convex, posterior portion of whorls truncated, slope from apex to end of body whorl gradual; exact nature of aperture undeterminable; no ornamentation present with the exception of varices situated at 180° position.

Measurements: Type, length 70, maximum thickness 37 mm. The extreme apical end of the type is missing.

A. travisensis is distinguished from all other species of Aporrhais in the Travis Peak in being much larger.

Occurrence: Cow Creek beds. The type was collected from this stratigraphic position on Mr. Milam's Place, Cox's Crossing, Travis County.

TURRITELLIDAE

Genus TURRITELLA Lam.

Turritella sp.

Pl. XXIV, Fig. 1

Cast medium, elongate, apical angle small; number of whorls undeterminable, not in contact, rounded

between sutures; sutures deep, increase in size of volutions from apex to body whorl gradual, rounded in cross section; aperture unknown; surface ornamentations absent.

Measurements: Incomplete cast, length 16, and thickness 12 mm.

The species of the specimen at hand is undeterminable. It is mentioned only because of its presence in the Cow Creek beds.

Occurrence: Cow Creek beds. The figured specimen was collected from this zone 5 miles west of Cox's Crossing, Burnet County.

Turritella (?) burnetensis sp. nov.

Pl. XXIV, Figs. 2-3

Shell very small, elongate; high spire; apical angle small, 8 to 10 volutions, which are distinctly marked by sutures represented as depressions between slightly convex whorls; whorls ornamented by four spiral ribs which are of varying height and width; increase in size of chambers from protoconch to body whorl gradual.

Measurements: Type, length 6, thickness of body whorl 1.5 mm. Other specimens have proportionate size but are usually smaller.

This species is usually represented as calcite pseudomorphs. Because of its small size, confusion with other species of Turritella is quite unlikely.

Occurrence: Cow Creek beds five miles west of Cox's Crossing, Burnet County.

Turritella travisensis sp. nov.

Pl. XXIV, Figs. 4-5.

Cast small, elongate; apical angle about 16°, volutions about 7 to 8 in number, rapidly increasing in size from the apex to body whorl, enlargement uniform; sutures distinct, depressed; whorls slightly convex between suture lines; surface of whorls ornamented by a number of low, angular, spiral ribs; areas between ribs about twice as wide as ribs; aperture not visible in cast.

Measurements: Approximate length 23, and maximum thickness of body whorl 7 mm.

Occurrence: Cow Creek beds. The specimen figured was collected on Mr. Milam's place, Cox's Crossing, Travis County.

NERINEIDAE

Genus NERINEA Defrance

Nerinea texana Roemer

Pl. XXIV, Fig. 6.

1849. Nerinea sp. ind. Roemer, Texas, p. 412.

1852. Nerinea texana Roemer, Kreide von Texas, p. 41, Taf. 4, Fig. 7, Bonn.

1928. Nerinea texana Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2938, p. 187.

Following is a translation of Roemer's description of N. texana as given by Whitney: [28]

> "Shell elongate, turreted; the whorl in the cast separated by a spiral groove; nearly one-third of the entire width of the whorl consists in its lower portion of a raised keel-like part; the upper, larger portion of the whorl quite flat and even, and is so applied to the lower part of the preceding whorl that the latter is scarcely prominent.

---

[28] Whitney, Marion I., Fauna of the Glen Rose, Manuscript as of April 9, 1931.

> Of this species there are at hand a dozen specimens preserved as casts. These casts mostly resemble those of Nerinea visurgis (A. Roemer, Verst. des Nordd. Oolithen Geb. Tabl. XI, Fig. 26) from the upper Jurassic (Portland Chalk) at Hildisheim, and they are differentiated, however, in that the keel, which is separated from the remainder of the whorl, is smaller and less sharply angled that in the Jurassic species as well as by the lesser width of the groove.
>
> Locality: Common at Fredericksburg; also in a place high on the Pedernales River with the following species....."

Roemer undoubtedly had reference to the lower Trinity Division when he made references to the Pedernales River. The probability is that he had specimens which he collected from the Travis Peak. Specimens from the Travis Peak and Glen Rose are very similar.

Occurrence: Cow Creek beds of the Travis Peak and Glen Rose formations. The figured specimen was collected along the Pedernales River at Hammett's and Cox's Crossing.

CEPHALAPODA

TETRABRANCHIATA

AMMONOIDEA

PARAHOPLITIDAE

Genus DUFRENOYA Burckhardt

Dufrenoya aff. dufrenoyi (d'Orbigny)

Pl. XXV, Figs. 1-2.

1841. Ammonites dufrenoyi d'Orbigny, Pal. France Terr. Cret. I, p. 300, pl. 33, figs. 4-6.

1849. Ammonites dufrenoyi Quenstedt, Cephalopoden, l. c., p. 158, pl. X, figs. 10a-b.

1925. Dufrenoya aff. dufrenoyi Burckhardt, Faunas del Aptiano de Nazas (Durango), Instituto Geologico de Mexico, Bol. Nu. 45, p. 18, Lam. X, figs. 1-4, 7-9.

Cast small, laterally compressed, usually consisting of about three whorls; umbilicus very evident, distinctly depressed, margin of whorl truncate; lobes and saddles almost equal; about 21 or 22 bifurcate ribs in each volution; ribs elevated near peripheral margin, appearing to droop when crossing venter.

Measurements: Diameter of average specimen, length about 50, thickness about 10 mm.

D. aff. dufrenoyi appears to have about the same characteristics as D. roemeri (Cragin) except that it has approximately five more ribs.

Occurrence: Abundant in the Cow Creek beds; figured specimen from Cow Creek, Travis County. Occurs with D. roemeri.

Dufrenoya roemeri (Cragin)[29]

Pl. XXV, Fig. 3.

1893. Hoplites roemeri Cragin, A Contribution to the Invertebrate Paleontology of the Texas Cretaceous, Geol. Survey of Texas, Fourth Annual Report, pp. 234-235.

1925. Dufrenoya roemeri Burckhardt, Faunas del Aptiano de Nazas (Durango), Inst. Geol. Mexico, Bol. 45, pp. 18, 30, 61, Lam. IX, figs. 3-15.

1925. Dufrenoya texana Burckhardt, Faunas del Aptiano de Nazas (Durango), Inst. Geol. Mexico, Bol. 45, pp. 30, Lam. IX, figs. 3-15.

1938. Dufrenoya roemeri Adkins, Handbook of Texas Cretaceous Fossils, Univ. of Texas Bull. 2938, p. 253.

---

[29] Cragin, F. W., Paleontology of the Texas Cretaceous, Geol. Survey of Texas, 4th Annual Report, pp. 234-235.

> "Small, laterally compressed, consisting of about three volutions; umbilicus one-third to one-fourth as large as the major diameter of the coil; cross-section of whorl elevated, narrowed and truncate above; principal leaves and saddles sub-equal, much as in H. dufrenoyi d'Orb. (the smaller ones and the character of the dissection of the sutural line not shown in type); about thirty-seven alternately complete and short ribs (partly transitional from eighteen or nineteen bifurcate ones); ribs continuous over the flattened venter, each raised into a node at either ventro-lateral angle, so that the rib appears to droop in crossing the mid-region of the venter."

Measurements: Diameter of average specimen, length about 50, thickness 10 mm.

Dufrenoya roemeri is the most abundant ammonite in the Travis Peak. This is apparently the same species as Burckhardt considered as Dufrenoya texana. Burckhardt collected the type material of D. texana from Comb's Hollow in western Travis County. The type material of D. roemeri was collected on Cow Creek about one mile below the Travis Peak post office. These two localities are situated very close together, being only approximately 2.5 or 3 miles apart. It is more than likely that the specimens of both species were collected from the same zone and are probably the same.

Occurrence: Abundant in the Cow Creek beds; type locality is on Cow Creek, Travis County.

CONCLUSIONS

1. The Travis Peak formation is divided into three parts: the lower, Sycamore member, consisting of conglomerates, sands, and clays; the middle, the Cow Creek member , consisting essentially of limestones; and the upper, Hensell member, consisting of sands and clays.

2. The formation, as a whole, thins southward from its type locality on Cow Creek in Travis County.

3. The fauna of the Travis Peak, is for most part, restricted to the Cow Creek beds, and consists chiefly of pelecypods and gastropods, with a few ammonites, corals, and foraminifera.

4. The Travis Peak rests on Pennsylvanian rocks of varying age due to the overlap of the Travis Peak on an angular unconformity.

5. The position of the Glen Rose-Travis Peak contact is purely arbitrary. There is no stratigraphic break between the two formations.

6. The fauna of the Travis Peak resembles very closely that of the Glen Rose. The writer believes that upon further study of the Glen Rose, the fauna of the two formations will be found to be almost

identical and that they should be grouped under one name, with the Travis Peak a special facies of the Glen Rose.

BIBLIOGRAPHY

Adkins, W. S. and Winton, W. M.: Paleontological Correlation of the Fredericksburg and Washita Formations in North Texas, University of Texas Bulletin, No. 1945, 1919.

Adkins, W. S.: The Geology and Mineralogy Resources of McLennan County, University of Texas Bulletin, No. 2340, 1923.

Adkins, W. S.: Handbook of Cretaceous Fossils, University of Texas Bulletin, No. 2838, 1928.

Baker, C. L.: Exploratory Geology of a Part of Southwestern Trans-Pecos Texas, University of Texas Bulletin, No. 2745, 1927.

Beede, J. W. and Waite, V. V.: The Geology of Runnels County, Texas, University of Texas Bulletin, No. 1816, 1918.

Böse, Emilio: La Fauna de Moluscas del Senoniano de Carsenas, San Luis Potosi, Instituto Geologico de Mexico, Bol. 24, 1906.

Böse, Emilio: Monographia geologica y paleontologica del Cerro de Muleros: Instituto Geologico de Mexico, Bol. Nu. 25, 1910.

Böse, Emilio: Algunas faunas del cretacico superior de Coahuila y regiones limitrofes, Instituto Geologico de Mexico, Bol. Nu. 30, 1913.

Böse, Emilio: On a New Exogyra from the Del Rio Clay and some Observations on the Evolution of the Exogyra in the Texas Cretaceous, University of Texas Bulletin, No. 1902, 1919.

Böse, Emilio: Algunas faunas cretacicas, Instituto Geologico de Mexico, Bol. Nu. 42, 1923.

Böse, E. and Cavins, O. A.: The Cretaceous and Tertiary of Southern Texas and Northern Mexico, University of Texas Bulletin, No. 2748, 1927.

Boyle, C. B.: A Catalogue and Bibliography of North American Mesozoic Invertebrates, U. S. Geological Survey, Bulletin 102, 1893.

Brill, V. A.: The Travis Peak Formation, Unpublished M. A. Thesis, University of Texas Archives, 1928.

Bullard, F. M.: Geology of Love County, Oklahoma, Oklahoma Geological Survey Bulletin 33, 1925.

Bullard, F. M.: Geology of Marshall County, Oklahoma, Oklahoma Geological Survey Bulletin 39, 1926.

Bullard, F. M.: Lower Cretaceous of Western Oklahoma, Oklahoma Geological Survey, Bulletin 47, 1928.

Burckhardt, Carlos: La Faune Jurassique de Mazapil. Instituto Geologico de Mexico, Bol. Nu. 23, 1906.

Burckhardt, Carlos: Faunes Jurassiques et Cretaciques de San Pedro del Gallo, Bol. Nu. 29, 1912.

Burckhardt, Carlos: Faunas Jurasicas de Syman (Zacatecas), Instituto Geologico de Mexico, Bol. Nu. 33, 1919.

Burckhardt, Carlos: Faunas del Aptiano de Nazas (Durango). Instituto Geologico de Mexico, Bol. Nu. 45, 1925.

Burckhardt, Carlos: Etude Synthetic sur le Mesozoique Mexicain, Me. Soc. Paleon. Suisse, vol. IL-L. 1930.

Bybee, H. P.; and Bullard, Fred M.: Geology of Cooke County, Texas, University of Texas Bulletin, 2710, 1927.

Carsey, Dorothy O.: Foraminifera of the Cretaceous of Central Texas, University of Texas Bulletin, No. 2612, 1926.

Choffat, Paul: "Especes Nouvelles ou peu Connues," Recueil d'Etudes Paleontologiques sur la Faune Cretacique due Portugae. Vol. I, 1886.

Choffat, Paul: Faune Cretacique du Portugal, Vol. I, Lisbonne, 1886.

Clark, W. B.: The Mesozoic Echinodermata of the United States, U. S. Geological Survey, Bull. No. 102, 1893.

Clark, W. B. and Twitchell, M. T.: The Mesozoic and Cenozoic Echinodermata of the United States, U. S. Geol Survey, Mono. 54. 1916.

Conrad, T. A.: Report of the United States and Mexican Boundary Survey, Vol. I, 1857.

Coquand, M. H.: Monographie Paleontologique de l' Etage Aptien de l'Espagne, Paris, 1866.

Coquand, M. H.: Monographie Du Genre Ostrea, J. B. Bailliere and Fils, Paris, 1869.

Correlation Papers-- Cretaceous: U. S. Geological Survey, Bulletin 82, 1891.

Cragin, F. W.: Invertebrate Paleontology of the Texas Cretaceous, Texas Geological Survey, Fourth Annual Report, 1893.

Cragin, F. W.: Description of Invertebrate Fossils from the Comanche Series in Texas, Kansas and Indian Territory, Colorado College Studies,

Cragin, F. W.: Notes on Some Fossils of the Comanche Series, Science new. ser., Vol. 6, 1897.

Cragin, F. W.: Paleontology of Malone Jurassic Formation of Texas, U. S. Geol. Survey Bull. 266, 1905.

Cummings, W. F.: Geography, topography, and Geology of the Llano Estacado or Staked Plains, Texas Geol. Survey, Third Annual Report. pp. 129-223, 1892.

De Loriol, P.: Monographie des couches de l' Etage Volanginen des Corrieres d'Arzier (Vaund), Materiaux pour Paleontologic Suisse, 1863.

Deshayes, G. P.: Description des Coquilles Fossils des Environs de Paris, Paris, 1824.

Deussen, Alexander: Geology of the Coastal Plain West of the Brazos River, U. S. Geol. Survey, Prof. Paper 126, 1924.

D'Orbigny, A: Descriptions de Mollusques et Rayonnes Fossils Terraines Cretaces, Tom.1, Texte Atlas; Tom. 2, Texte, Atlas; Tom. 3, Texte, Atlas, Paleontologic Francaise, 1843-1847.

Douville, H.: Sur les couches a Rudistes du Texas, Bull. Soc. Geol. France, No. 3, p. 387, 1898

Douville, H.: Sur quelques Rudistes americains, Texas, Bull. Soc.Geol.France,XXVIII, p.218,1900.

Douville, H.: Sur la distribution geographique des Rudistes, des Orbutolines et des Orbitoides, Bull.Soc.Geol.France, No.3, XXVIII,p.222, 1900.

Dumble, E. T.: The Geology of East Texas, Univ. of Texas Bull. 1869, 1918.

Fischer, Paul: Manuel de Conchyliogie et de Paleontologie, Paris, 1887.

Gordon, C.H.: Geology and Underground Waters of North - eastern Texas, U.S. Geol. Survey, Water Supply Paper 276, 78 pp. 2pls. 1911.

Gould, C. N.: Lower Cretaceous of Kansas, Am. Geol. Vol. 25, pp. 10-40, 1900.

Ellisor, A. C.: Species of Turritella From the Buda and Georgetown Limestone of Texas, University of Texas Bulletin No. 1840, 1918.

Greco, B.: "Fauna Cretacea dell' Equitto Raccolta dal Figarie Bey; Lamellibranchi del Turoniano e del Cenomaniano, Paleontographia Italica, Vol. 24, 1918.

Henderson, G. G.: The Geology of Tom Green County, University of Texas Bulletin No. 2807, 1928.

Hill, R. T.: Present Knowledge of the Geology of of Texas, U. S. Geol. Survey Bulletin 45, 1887.

Hill, R. T.: Texas Section of the American Cretaceous Am. Jour. Science., 3d. ser., Vol. 34, pp. 287-309, 1887.

Hill, R. T.: Trinity Formation of Arkansas, Indian Territory, and Texas, Science, Vol. 17, p. 21, 1888.

Hill, R. T.: Neozoic Geology of Southwestern Arkansas Arkansas Geol. Survey, Ann. Report for 1888, Vol. 2, 1889.

Hill, R. T.: Cretaceous Rocks of Texas and Their Economic Uses, Geol. Survey of Texas, 1st Annual Report, 1889.

Hill, R. T.: Events in North American Cretaceous History Illustrated in the Arkansas Texas Region, Am. Jour. Science, 3d. ser. Vol. 37, pp. 282-290, 1889.

Hill, R. T.: Annotated Check List of the Cretaceous Invertebrate Fossils of Texas, Texas State Geol. Survey, Austin, 1889.

Hill, R. T.: Paleontology of the Cretaceous Formations of Texas, Austin, 1889.

Hill, R. T.: The Comanche Series of the Arkansas-Texas Region, Bull.Geol. Soc. Am.,Vol 2, pp.503-528, 1890.

Hill, R. T.: A Brief Description of the Cretaceous Rocks of Texas and their Economic Value, Texas Geol. Survey, First Annual Report, For 1889 -- pp. 103 - 141. 1890.

Hill, R. T.: Notes on the Texas-New Mexico Region, Bull. Geol. Soc. Am., Vol. 3, pp. 85 - 100, 1891.

Hill, R. T.: Invertebrate Paleontology of the Trinity Division, Biol. Soc. Wash., Volume VIII, 1893.

Hill, R. T.: The Paleontology of the Cretaceous Formation of Texas, Proceeds, Bio. Soc. Wash. VIII. Washington, 1893.

Hill, R. T.: Geology of parts of Texas, Indian Territory and Arkansas adjacent to Red River, Bull. Soc. Am., Vol. 5, pp. 297 - 338, 1894.

Hill, R. T.: Geology of the Edwards Plateau and Rio Grande Plain Adjacent to Austin and San Antonio, Texas, with references to the occurence of Underground Waters, U. S. Geol. Survey, Eighteenth Annual Report, Part 2, 1897.

Hill, R. T.: The Lower Cretaceous Gryphaeas of the Texas Region, U. S. Geol. Bull. 161, 139 pp. 35 pls., 1898.

Hill, R. T.: The Geology and Geography of the Black and Grand Prairies of Texas, U. S. Geol. Survey, 21st Annual Report, Part 7, 1901.

Hill, R. T. and Vaughan, T. W.: Austin Folio, U. S. Geol. Survey Geol. Atlas. (No. 76), 1902.

Hyatt, A: Pseudoceratites of Cretaceous, U. S. Geol. Survey, Mono. 44, 1903.

Kniker, H. T.: Commanchean and Cretaceous Pectinidae of Texas, University of Texas Bull. No 1817, 1918.

Lasswitz, R.: Ammoniten von Texas, Geoligishe und Paleontologische Abhandlungen, Neue Folge 6 Jena, 1902 - 1905.

Liddle, R. A.: The Geology and Mineral Resources of Medina County, Univ. of Texas Bull. No. 1860, 1918.

Marcou, Jules: Notes geologiques sur le pays compris entre Preston sur le riviere rouge, et El Paso, sur Rio Grande, Bull. Geo. Soc. France, 2d Ser. Vol. 12, pp. 808-813, 1855.

Marcou, Jules: Resume and field notes, Rept. Exploration for Railroad route from the Miss. Riverto Pacific Ocean, Vol. 3, pt. 4, pp. 121 - 164, 1856.

Marcou, Jules: Notes on the Cretaceous and Carboniferous rocks of Texas, Proc. soc. Nat. Hist. Boston. Vol.8. pp. 86 - 97, 1861.

Marcou, Jules: Growth of knowledge concerning the Texas Cretaceous, Am. Geol. Vol. 14. pp. 98-105, 1894.

Merril, J. A.:Fossil Sponges of the Flint Nodules in the Lower Cretaceous of Texas, Howard College museum of Comp. Zoology, Bull. No. 28, 1896.

Miser, H. D.: Lower Cretaceous Rocks of Southeastern Oklahoma and southestern Arkansas, Bull. Am. Asso. Pet. Geol. Vol. 11, No. 5, pp. 443 - 454, 1927.

Morton, S. G.: Synopsis of the Organic Remains of the Cretaceous Group of the United States, Philadelphia, 1834.

Paige, Sidney: Llano Burnet Folio, Geologic Atlas of the United States, No. 183. 1912.

Pellat, E. and Cossmann, M.: Le Barremien Superieur a Facies Urgonien, Memoires de le Societe Geologique de France, Memoire No. 27, Paris, 1907.

Pervinquiere, L.: Etudes de Paleontologie Tunisienne; Gastropodes et Lamellibranches des Terains Cretaces, Carte Geologique de la Tunisie, Paris, 1912.

Pictet, F. J.: Traite de Paleontologie ou Histoire Naturelle des animaux fossils, Paris 1853 - 1857.

Pictet, F. J. et Campiche, G.: "Descriptions des Fossils du terrain Cretace des environs de St. Craix," Mater Pour la Paleont. Suisse, Geneve et Bale, 1858 - 1873.

Pictet, F. J. et De Loriol: "Description des Fossils Continus dans le Terrains neocomian des Voirons," Mater pour la Paleont, Suisse, Geneve, 1858.

Pictet et Renevier: "Description des Fœsils du Terrain Aptien de la Perte du Rhone et des environs de St. Croix,", Mater pour la Paleont. Suisse, Geneve, 1858.

Pirsson, L. V. and Schuchert, Chas.: Textbook of Geology, Part II, John Wiley and Sons, 1924.

Prosser, C. S.: Comanche series of Kansas, Univ. Geol. Survey of Kansas, Vol. 2, pp. 51 - 194. 1897.

Prather, J. K.: On the Fossils of the Texas Cretaceous, especially those collected at Austin and Waco, Trans. Texas acad. Sci., Vol. IV, pp. 85 - 87, 1901.

Roemer, F.: A Sketch of the Geology of Texas, Am. Journ. of Sci., 2d. Ser. Vol. 6, pp. 358 - 365, 1846.

Roemer, F.: Contributions to the Geology of Texas, Am. Jour. Sci. 2d, ser. Vol. 6, pp. 21 - 28, 1848.

Roemer, F.: Texas, Bonn. 1849.

Roemer, F.: Die kreidebldungen von Texas, und ihre organischen Einschulusse, Bonn, 1852.

Roemer, F.: Haeufigkeit hippuriten-artiger Chamiden ausgezeichnete fauna Der Oberturonen kreide Von Texas, Berlin, 1888.

Scott, Gayle: On A New Correlation of the Texas Cretaceous, Am. Journal of Sci., Vol. 12. pp. 157 - 161, 1926.

Scott, Gayle: Etudes stratigraphiques et Paleontologiques sur les Terrains cretaces du Texas, Grenoble, 1926.

Sellards, E. H.: The Geology and Mineral Resources of Bexar County, Univ. of Texas Bull. No. 1932, 1919.

Shattuck, G. B., The Mollusca of the Buda Limestone, U. S. Geol. Survey Bull. 205, 1903.

Shumard, Geo. G.: Remarks upon the General Geology of the Country passed over by the exploring expedition to the sources of the Red River, Exploration Red River of Louisiana, pp. 179 - 195, 1852.

Shumard, B. F.: Descriptions of the Species of Carboniferous and Cretaceous fossils, Exploration Red River of Louisiana by Cap't. R. B. Marcy, pp. 199 - 210, pls. 1 - 4. 1852.

Shumard, B. F.: Observations upon the Cretaceous Strata of Texas, Trans. St. Louis Acad. Sci., Vol. I, pp. 282 - 590, 1860.

Shumard, B. F.: Description of New Cretaceous fossils from Texas, Trans, St. Louis Acad, Sci., Vol. I, pp. 590 - 610, 1860.

Shumard, B. F.: Section of the Cretaceous Strata in Texas, Proc. Boston Soc. Nat. Hist., Vol. 8, pp. 89, 1862.

Shumard, B. F.: Description of New Cretaceous Fossils from Texas, Boston Soc. Nat. Hist., Vol. 8, pp. 188 - 205, 1862.

Shumard, Geo. G.: Partial Report of the Geology of Western Texas Consisting of a General Geologi-

cal Report and Journal of Geological Observations along the route traveled by the Expedition between Indianola, Texas, and the Valley of the Mimbres, New Mexico during 1855 and 1856, with an appendix giving a detailed report on the geology of Grayson County, State Printing Office, Austin, 1886.

Simonds, F. W.: Bibliography of Texas for Decade, 1890 - 1900, Trans. Texas Acad. Sci. III, 1900.

Stanton, T. W.: Lower Cretaceous formations and and faunas, Jour. of Geol., vol. 5, pp. 579 - 624, 1897.

Stanton, T. W.: The Cretaceous of Texas, Am. Jour. Sci., vol. 13, pp. 517 - 522, 1927.

Stanton, T. W. and Vaughan, T. W.: Section of the Cretaceous at El Paso, Texas, Am. Jour. of Sci., 4th Ser. vol. 1, pp. 21 - 26, 1896.

Stephenson, L. W.: Cretaceous Deposits of the Eastern Gulf Regions and Species of Exogyra from the Eastern Gulf Regions and the Carolinas, U. S. Geol. Survey. Prof. Paper 81, Wash, 1914.

Stephenson, L. W.: A Contribution to the Geology of Northeastern Texas and Southern Oklahoma U. S. Geol. Surv. Prof. Paper, 120, Washington, 1918.

Stephenson, L. W.: The Cretaceous Formations of North Carolina, North Carolina Geol. and Econ. Surv. Raleigh, 1923.

Stoliczka, J.: Cretaceous Pelecypoda of Southern India, Memoirs of the Geol. Surv. of India, vol. 3, Parts 1 - 13, 1871.

Taff, J. A.: Report on the Cretaceous Area North of the Colorado River, Texas Geol. Surv., 4th Annual Report, pp. 239 - 354. 1893.

Taff, J. A.: Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma, U. S. Geol. Surv. Prof. Paper 31, 1904.

Twenhofel, W. H.: Geology and Invertebrate Paleontology of the Comanchean and Dakota Formations of Kansas, Kansas State Geol. Surv. Bull. 9, 1924.

Twenhofel, W. H.: The Comanchean of Central Kansas, Trans. Kansas Acad. Sci., vol. 28, pp. 218 - 223, 1918.

Twenhofel, W. H.: The Comanchean and Dakota Strata of Kansas, Am. Jour. Sci., 4th Ser., vol. 49, pp. 281 - 297, 1920.

Uddèn, J. A., Baker, C. L., and Böse, E.: Review of the Geology of Texas, Univ. of Texas Bull. 44, 4th Edition, 1919.

Vaughan, W. W., Additional notes on the outlying areas of the Comanche Series in Oklahoma and Kansas, Am. Jour. Sci., 4th Ser., Vol. 4, pp. 43 - 50, 1897.

Weller, Stuart, A Report on the Cretaceous Paleontology of New Jersey, Geol. Surv. of New Jersey, Trenton, N. J., 1907.

Wells, J. W.: Corals of the Trinity Division of the Comanchean of Central Texas, Unpublished manuscript, 1930.

Winton, W. M., and Adkins, W. S.: Geology of Tarrant County, Univ. of Texas Bull. 1931, 1919.

Winton, W. M. and Scott, Gayle: The Geology of Johnson County, Univ. of Texas Bull. No. 2229, 1922.

Winton, W. M.: The Geology of Denton County, Univ. of Texas Bulletin, No. 2544, 1925.

Whiteaves, J. J.: Mesozoic Fossils, Geol. Survey of Canada, Vol. 1, parts 1 - 5, 1876.

White, C. A.: Description of New Cretaceous Invertebrate Fossils from Kansas and Texas, Proc. U. S. Nat. Mus. for 1879, vol, 2, pp. 292 - 298. 1880.

White, C. A.: Contributions to Invertebrate Paleontology No. 2; Cretaceous fossils of the Western states and Territories, U. S. Geol and Geog. Surv. Terr., (Hayden), 12th Annual Report. (1878), part 1, pp. 5 - 39. 1880.

White, C. A.: On Mesozoic Fossils, U. S. Geol. Surv. Bull. 4, 1884.

White, C. A.: On the Cretaceous formations of Texas and their relations to those of other portions of North America, Proc. Phila. Acad. Nat. Sci. pp. 39 - 47, 1887.

White, C. A.: The Lower Cretaceous of the Southwest and its relation to the underlying and overlying formations, Am. Jour. Sci., 3d ser., vol. 38, pp. 440 - 445, 1889.

White, C. A.: A review of the fossil Ostreidae of North America and a comparison of the fossil forms with the living forms, U. S. Geol. Surv. 4th Ann. Rept. 1883.

Whitney, F. L.: The Fauna of the Buda Limestone, Proc. Texas Acad. Sci., 1913.

Whitney, F. L.: The Echinoidea of the Buda Limestone, Bul. Amer. Paleontology, No. 26, 1916.

Whitney, F. L.: Bibliography and Index of North American Mesozoic Invertebrata, Bull. Amer. Paleontology, vol. 12, No. 48, Ithaca, 1928.

Woods, Henry, A.: Monograph of the Cretaceous Lamellibranchia of England, Paleontolographical Society,

Woodward, S. P.: A Manual of the Mollusca, Reprint of 4th Edition, (1880), London, 1890.

Zittel, C. A.: Textbook of Paleontology, MacMillan and Co., 1913.

PLATES

PLATE I

Orbitolina texana (Roemer)

Fig. 1. View showing variation in size, 1X

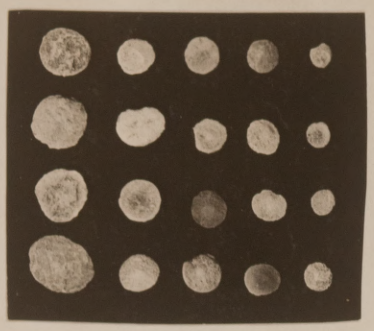
Orbicella travisensis Wells

Fig. 2. Transverse section, 2X
3. Thin transverse section, 3X
4. Thin longitudinal section, 3X

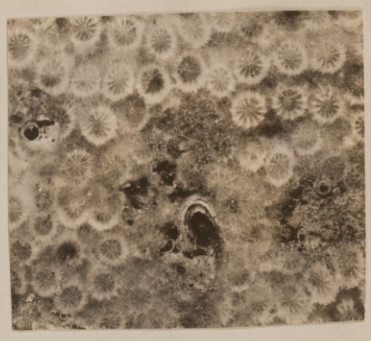
Siderastrea cuyleri Wells

Fig. 5. Transverse section, 1X
6. Transverse section of corallites, 3X

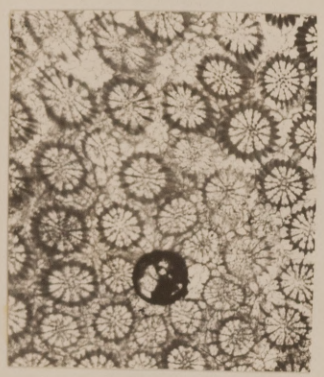
PLATE I



1

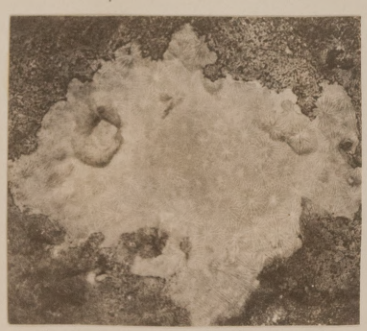


2

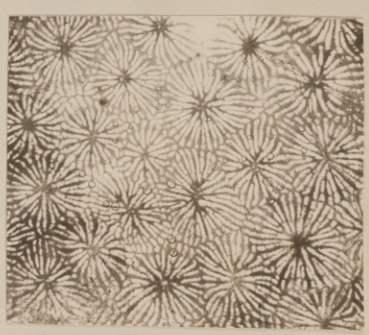


3

4



5



6

PLATE II

(Illustrations natural size)

Nucula tharpi sp. nov.

Fig. 1. Side view
2. Top view
3. End view

Cucullaea gracilis Cragin

Fig. 4. Side view
5. End view
6. Top view

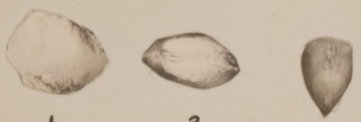
Cucullaea hamletti sp. nov.

Fig. 7. Side view showing teeth

Cucullaea sellardsi sp. nov.

Fig. 8. Side view
9. Top view
10. End view

PLATE II

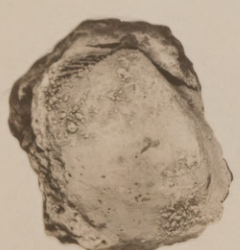


1 2 3

4

5

6



7

8 9 10

PLATE III

(Illustrations natural size)

Cucullaea terminalis Conrad

Fig. 1. Side view
2. Top view
3. End view

Avicula eifleri sp. nov.

Fig. 4. Side view showing characteristic folds

1

2

3

4

PLATE IV

(Illustrations natural size)

Avicula whitneyi sp. nov.

Fig. 1. Side view showing characteristic dentition and general features of cast.

Exogyra bullardi sp. nov.

Fig. 2. Exterior of superior valve.

PLATE IV

1

2

PLATE V

(Illustrations natural size)

Exogyra bullardi sp. nov.

Fig. 1. Interior of superior valve
2. Exterior of inferior valve

1

2

PLATE VI

(Illustrations natural size)

Exogyra bullardi sp. nov.

Fig. 1. Interior of superior valve
2. Inferior and superior valve

1

2

PLATE VII

(Illustrations natural size)

Exogyra bullardi sp. nov.

Fig. 1. Edge view showing both valves

Exogyra hilli Cragin

Fig. 2. View of superior valve
3. Edge view showing both valves

Exogyra weatherfordensis Cragin

Fig. 4. Exterior of superior valve
5. Exterior of inferior valve
6. Side view showing both valves
7. Edge view showing both valves

Ostrea camelina Cragin

Fig. 8. Exterior of larger valve
9. Interior of larger valve

PLATE VII

1

2

3

4

5

6

7

8

9

PLATE VIII

(Illustrations natural size)

Ostrea camelina Cragin

Fig. 1. View showing both valves
2. View showing exterior of elongated form
3. View showing both valves of an elongated form

1

2

3

PLATE IX

(Illustrations natural size)

Ostrea franklini Coquand

Figs. 1 - 6. Views showing variation of this species in the Travis Peak

PLATE IX

1

2

3

4

5

6

PLATE X

(Illustrations natural size)

Ostrea whitneyi sp. nov.

Fig. 1. View of exterior of large valve
2. View of interior of large valve

PLATE X

1

2

PLATE XI

(Illustrations natural size)

Ostrea whitneyi sp. nov.

Fig. 1. Exterior portion of small valve
2. Interior portion of small valve

PLATE XI

1

2

PLATE XII

(Illustrations natural size)

Ostrea whitneyi sp. nov.

Fig. 1. Edge view showing both valves.

Ostrea alternans Cragin

Fig. 2. Exterior of large valve showing plications.
3. Interior of large valve showing hinge structure.

1

2

3

PLATE XIII

(Illustrations natural size)

Ostrea estherae sp. nov.

Fig. 1. Exterior of superior valve showing plications
2. Both valves

Trigonia concentrica Cragin

Fig. 3. Side view
4. Top view
5. End view

Trigonia hilli sp. nov.

Fig. 6. Side view showing shape of cast and portion of dentition
7. Upper view of same structure

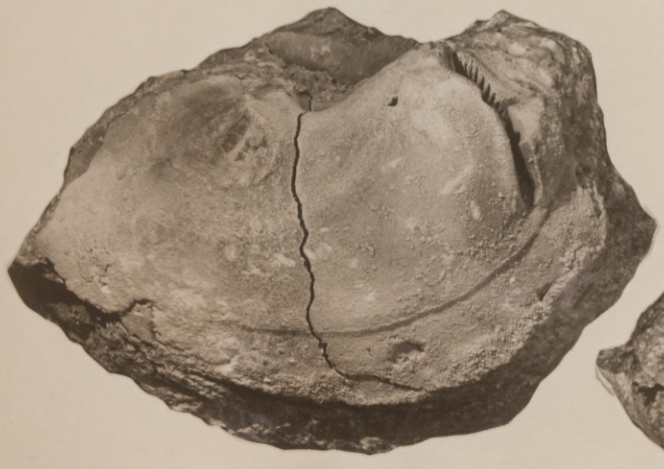
1

2

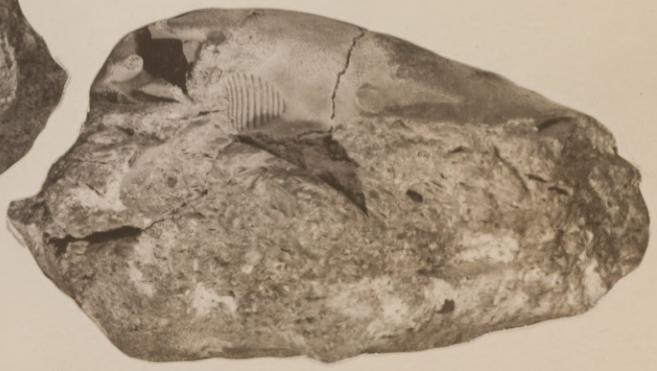
3

4

5



6



7

PLATE XIV

(Illustrations natural size)

Trigonia whitneyi sp. nov.

Fig. 1. Shell impression in Cow Creek beds. (Typical).
2. Shell impression with cast in its proper place.


1
2

PLATE XV

(Illustrations natural size)

Trigonia whitneyi sp. nov.

Fig. 1. Another typical shell impression in the Cow Creek beds.
2. Mold of above shell impression.
3. Side view of cast composing part of the type.
4. Top view.
5. End view.

Neithea sp.

Fig. 6. Side view.

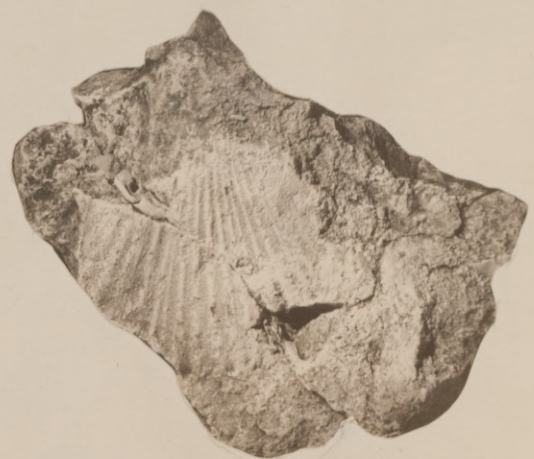
1

2

3

4

5



6

PLATE XVI

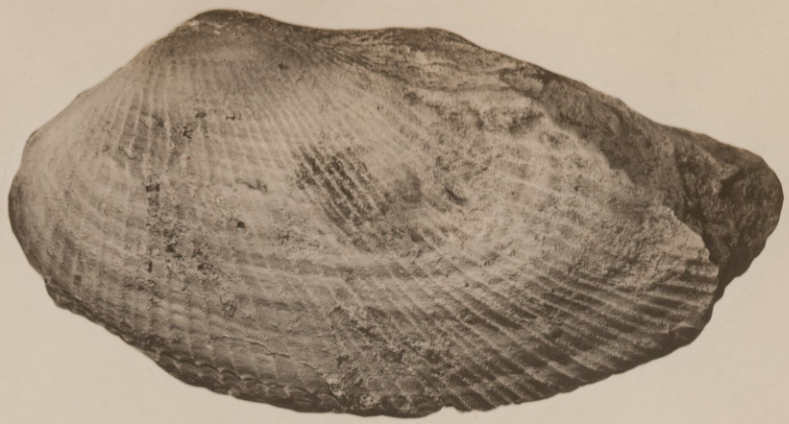
(Illustrations natural size)

Pholadomya aff. *gigantea* (Sowerby)

Fig. 1. Side view.
2. End view.
3. Top view.

Anatina brilli sp. nov.

Fig. 4. Side view.
5. Top view.
6. End view.



1

2

3

4

5

6

PLATE XVII

(Illustrations natural size)

Liopistha jurafacies (Cragin)

Fig. 1. Side view.
2. Top view.
3. End view.

Arctica mcallisteri sp. nov.

Fig. 4. End view.
5. Side view.
6. Top view.

PLATE XVII

1

2

3

4

5

6

PLATE XVIII

(Illustrations natural size)

Arctica medialis (Conrad)

Fig. 1. Side view.
2. End view.
3. Top view.

Arctica roemeri (Cragin)

Fig. 4. Side view.

Astarte pikensis (Hill)

Fig. 5. Side view.
6. Top view.
7. End view.

Remondia wellsi sp. nov.

Fig. 8, 9. Typical casts.

PLATE XVIII

PLATE XIX

(Illustrations natural size)

Cyrena arkansasensis Hill

Fig. 1. Side view.
2. End view.
3. Top view.

Cardita browni sp. nov.

Fig. 4. Side view.
5. Top view.
6. End view.

Phacoides potosina (Castillo and Aguilera)

Fig. 7. Side view, typical.

Protocardia goffi sp. nov.

Fig. 8. Side view.

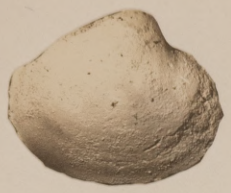
Protocardia multistriata Shumard

Fig. 9. Side view.

Protocardia aff. sphaeroidea (Forbes)

Fig. 10, 11. Side views.
12. Top view.

PLATE XIX



1

2

3

4

5

6

7

8

10

9

11

12

PLATE XX

(Illustrations natural size)

Cyprimeria whitneyi sp. nov.

Fig. 1. Side view.
2. Top view.

Meretrix stantoni sp. nov.

Fig. 3. Side view.
4. Top view.
5. End view.

Ptychomya wellsi sp. nov.

Fig. 6. Cast of external ornamentation, side view.
7. Internal cast showing dentition.
8. Mold from the cast in Fig. 6.

PLATE XX

1

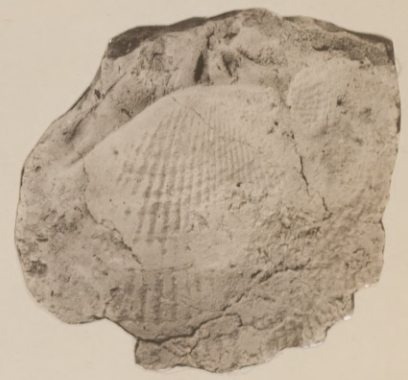
2

3

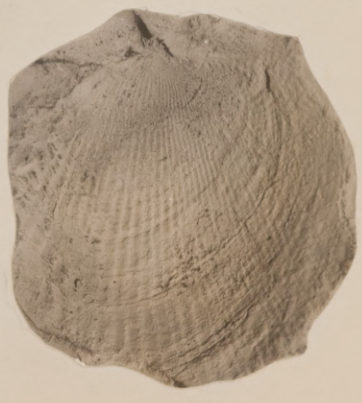
4

5

6



7



8

PLATE XXI

(Illustrations natural size)

Panopea solcheri sp. nov.

Fig. 1. Side view.
2. End view.
3. Top view.

Panopea pattoni sp. nov.

Fig. 4. Side view.
5. Top view.
6. End view.

Turbo konzi sp. nov.

Figs. 7, 9. Lateral views.
8. Top view.
10, 11. Internal casts.

PLATE XXI

1

2

3

4

5

6

7

8

9

10

11

PLATE XXII

(Illustrations natural size)

Turbo aff. *munitus* Forbes.

Fig. 1, 2. Side views.
3. Top view.

Natica travisensis sp. nov.

Figs. 4, 5. Side views.
6. Top view.

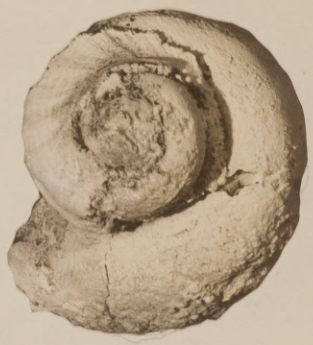
Tylostoma simondsi sp. nov.

Figs. 7, 8. Side views.
9. Top views.

PLATE XXII

1

2



3

4

5

6

7

8

9

PLATE XXIII

(Illustrations natural size)

Tylostoma bullardi sp. nov.

Figs. 1, 2. Side views.
3. Basal view.

Aporrhais deeni sp. nov.

Fig. 4. Mold of cast from Cow Creek beds.
5. Internal cast.

Aporrhais henryi sp. nov.

Fig. 6, 7. Side views.

Aporrhais simondsi sp. nov.

Fig. 8. Side view.

Aporrhais travisensis sp. nov.

Fig. 9. Side view.

PLATE XXIII

1

2

3

4

5

6

7

8

9

PLATE XXIV

(Illustrations natural size unless otherwise indicated)

Turritella sp.

Fig. 1. Side view.

Turritella (?) *burnetensis* sp. nov.

Fig. 2. Natural size of specimen.
3. Above specimen enlarged 4X.

Turritella travisensis sp. nov.

Fig. 4. Cast.
5. Mold from above cast.

Nerinea texana Roemer

Fig. 6. Side view.

1

2

3

4

5

6

PLATE XXV

(Illustrations natural size unless otherwise indicated)

Dufrenoya aff. dufrenoyi (d'Orbigny)

Fig. 1. Side view.
2. Edge view.

Dufrenoya roemeri (Cragin)

Fig. 3. Side view.

Typical geode

Fig. 4. Specimen collected from upper sands of the Travis Peak near Spring Branch, Comal County. 0.66X.

1

2

3

4